

**BRIAN LOWELL**  
OF YOUTUBE'S NEXT LEVEL GARDENING

# COMPANION PLANTING

*for Beginners*



**PAIR YOUR PLANTS FOR A BOUNTIFUL,  
CHEMICAL-FREE VEGETABLE GARDEN**



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# How to use this eBook

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*For Jeanne Wolgemuth, who took the little sprout of gardening passion I had and, through her inspiration and teaching, grew it into something that has been one of the great joys of my life. I wish you were still here to see the hundreds of thousands of gardeners you were able to touch in a way you would have never thought possible.*



## INTRODUCTION



Anyone can grow a garden! If you consider yourself to have a brown thumb—heck, if you’ve been accused of having a brown thumb—it doesn’t matter. I once was in the same boat but that was over 30 years ago. In the more than three decades since, my thumb has quickly turned from brown to green. And you know what? It wasn’t magic, and it didn’t take a college degree; it was just me, enjoying the process of gardening, making mistakes, and learning from the whole experience. Each year got better than the last, and each year I got better, both as a gardener and as a person. Gardening has made my life more full. It’s a love affair that goes back further than my son, and even further than my wife, and it’s a love affair that will stay with me until the day I die. It was the sheer love of planting and nurturing, and watching what I planted grow and produce flowers and fruit. It was the excitement of planning next year’s garden, and the anticipation that next year would be even better than the last. It was making the mistakes and learning new ways to make mistakes, but eventually I would, and did, figure it all out.

A few years into my gardening journey, I had the opportunity to meet my sister’s piano teacher, who just happened to also be a Certified Master Gardener. She happily took me under her wing, and for the next seven years, I spent countless hours with her in her garden, absorbing a treasure trove of knowledge from her decades of experience that she dispensed to me. Looking back, it was a transformative, almost magical time in my life, and one that I still deeply cherish. Through my

YouTube channel and this book, I hope to pass on the gift of inspiration and knowledge that I was freely given three decades ago by an amazing woman and gardener who probably never knew just how important a role she played in my life.

In the very near future, you, too, will find that each phase of the garden year, and each phase of your gardening journey, holds a magic that is never-ending, and is renewed every spring. If you are just starting out, I'm so excited for you because you don't yet know the wonders that are just around the corner. In addition to the wonders, there will be some letdowns on this new path, and that's okay. I remember a time when I sprayed an organic pesticide on my entire garden during the hottest part of an already hot day. The next day, I went out to find my entire garden wilted and dying. My garden never fully recovered, and I almost didn't, but I pulled it together and replanted. I had a shorter season that year, and a much smaller harvest, but you know what? I *never* made that mistake again. If I hadn't made those early mistakes, I wouldn't have been able to reap the incredible bounty of rewards this deeply soul-filling pastime provides. I've made many others, and so will you, but as gardeners, we learn, we grow, and we move on. Gardening is a cross between art and science, which is great, because being a gardener is a lot like being an artist and a scientist.

Through this book, I hope to not only teach you the basic principles of organic gardening and companion planting, but also to be your cheerleader and guide you through this incredible hobby that will feed your body, mind, and spirit. I've arranged the book in such a way that the elements are presented in the order you will be starting a new garden or a new season. In each chapter, I will cover the most important organic gardening subjects and how to use companion planting in conjunction with organic gardening practices to help you grow a garden that is nearly self-sustaining. It will take a few of years of consistent work on your part to get to that point, but I promise it will be some of the most rewarding work you have ever done. So roll up your sleeves and let's get growing!

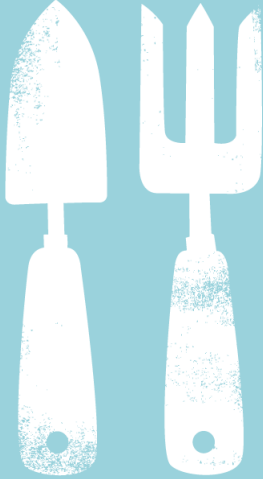
– Brian Lowell

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## CHAPTER 1

# AN INTRODUCTION TO COMPANION PLANTING & ORGANIC GARDENING

**WHAT IS COMPANION PLANTING?**

**WHY GROW ORGANICALLY?**

**ORGANIC GARDENING: A CAREFUL AND THOUGHTFUL STEWARDSHIP OF THE LAND**

**THE PRINCIPLES OF COMPANION PLANTING**

## WHAT IS COMPANION PLANTING?

By definition, companion planting is the practice of growing different plants together to achieve mutual benefit or for one plant to benefit from the other. The benefits of this practice include providing shade, retaining moisture, adding nutrients to the soil, providing protection from pests and disease, or attracting beneficial insects and pollinators. In some instances, companion planting is about knowing and understanding which plants *do not* grow well together and, instead, actually compete for nutrients or sunlight or even perpetuate disease. Some plants can even produce chemicals that will stunt or kill other plants if they're growing within a certain vicinity of each other. At its core, the study and practice of companion planting is understanding when and when not to use specific plant combinations to your garden's advantage. The goal is to not have to apply synthetic fertilizers or insecticides to your plants, instead to let nature do what it does best.





## HOW DID COMPANION PLANTING START?

Humans have been companion planting for centuries. Some of it was done by design, and some of it was done completely by accident. The best known historic example of companion planting is the Native American Three Sisters method, which is based on the three crops Native Americans relied on most: grain corn, beans, and squashes. In the Three Sisters method, the corn stalks give the beans a support to climb on, the large squash leaves shade the ground to keep weeds down and keep moisture in the soil, and the beans do what beans do best: pull nitrogen from the air and fix it in their root systems, leaving extra nitrogen in the soil for other plants. The Three Sisters concept is the embodiment of companion planting with each plant providing a useful service to its neighbor.

There is evidence that simple companion planting practices were used in Europe two to three thousand years ago. There are written historic examples of the ancient Romans knowing which nearby plants and trees would positively or negatively affect their grape and olive crops. In fourteenth-century England, cottage gardens became popular, though they were a little different than the cottage gardens we think of today. Today we might envision front gardens with rose-covered arbors and doorways, and flower beds burgeoning with all manner of flowers jockeying for position, while meandering paths and idyllic gates conjure up fairy tales. But in the fourteenth century, cottage gardening was about survival. The front gardens of cottage dwellers were used to grow vegetables, fruits, herbs, and whatever flowers could fit in. All of these plants were grown together as a matter of necessity. The fantastic by-product of this type of gardening was the discovery of the advantages that certain plants had when growing next to other plants. As time moved forward, this process was fine-tuned, and people were able to take note of these happy companion pairings to pass that knowledge down through generations. The French potage garden employed a similar practice that entailed growing fruits, vegetables, and herbs in beautiful arrangements that were feasts for the eyes, as well as the belly.





*Nasturtium is an excellent companion to green onions.*

**COMPANION PLANTING FOR TODAY'S GARDENER**

In the 1970s, when the organic gardening movement was just starting to take hold, companion planting principles were once again put into practice. And science started to explain and validate a lot of what people had been doing in the garden for all of those generations.

Unfortunately, it also uncovered evidence that some sworn practices were merely fables and did not actually do what they had been said to do, and that's where we are today: trying to separate the things that work from the things that don't work. Through science, we are also discovering new ideas and methods of companion planting that were previously unknown. It's an exciting time to be an organic gardener and a great time to start including companion planting in your own garden.

## **WHY GROW ORGANICALLY?**

I can't say I have always been an organic gardener. Growing up and gardening in the 1980s and 1990s, I never heard much talk about organic gardening, and I certainly wasn't practicing it in my own garden. I used chemical fertilizers like sulfate of ammonia and urea—the list goes on and on and is only matched by the types of chemical pesticides I used. I was always very careful not to get any on my skin as I was applying them, but I usually did. A book I once had explained the proper way to dress when applying pesticides to a garden: long pants and shirt, rubber gloves and boots, and even a shower cap and goggles. Yet, I had still planned to eat the things I was covering in these solutions, while dressed in what equated to a hazmat suit. (It sounds so ridiculous looking back now.) What I have learned since then is that the transition to growing organically takes time. The easiest change was moving away from using organic fertilizers. I'm still in the process of transitioning away from organic insecticides, but I'm in my second year and I'm seeing results. Converting your garden over to a 100 percent organic, insecticide-free garden will be a two- to three-year process, but the change will be worth the effort. With organic gardening and companion planting, you'll eventually be relying on nature's methods of eliminating pests and fertilizing plants.





## THE BENEFITS OF ORGANIC GARDENING

Here are just a few of the most compelling reasons to garden organically.

### **It Saves Our Precious Pollinators**

Seeing what nonorganic gardening compounds can do to the environment and to our much-needed pollinators, it's sad to know that thousands of gardeners still use the stuff. If you happen to be one of them, I can't blame you if you didn't know there are effective alternatives—indeed many gardeners don't— but hopefully I can shed some light on them for you. My goal is to help you see that chemical pesticides are unnecessary and that there are safer alternatives that protect pollinators. You really can have a beautiful and productive vegetable garden while using no pesticides whatsoever—organic or otherwise.



### **You'll Eat Healthier**

Organically grown produce has higher vitamin and mineral contents than produce grown with chemical fertilizers, and growing organically significantly increases certain types of flavonoids, which add antioxidant properties to fruits and vegetables.

### **Organic Produce Tastes Better**

Produce bound for the grocery store, including produce labeled as organic, is not bred and grown for taste, it's bred for travel and refrigeration. It's picked unripe, so it has a longer shelf life. Before I

grew organic vegetables, I hated tomatoes and would never eat one. That is, until I grew my own heirloom tomatoes and tasted the difference. It was like night and day. (Just wait until you grow your own!) It might not be an exaggeration to say it is life changing. Okay, maybe just a bit of an exaggeration, but really, store-bought tomatoes shouldn't be called tomatoes. After you've tasted one picked fresh from your own garden, you'll understand exactly what I'm talking about.

### **It's Good for the Body**

We all know that in order to live long, healthy lives, we need to eat right and exercise. Gardening will certainly help you eat right. But what you might not realize is how much exercise you will get as you're tending to your plants. It's the type of exercise that you don't have to schedule, you don't have to dress for, drive to, or have the right "look" for at a gym. It's fun, ever-changing movement in bright sunshine and fresh air, not on a treadmill.

### **It's Also Good for the Mind and Soul**

In addition to being physically beneficial, organic gardening is good for your spiritual and mental health. Getting your hands in the soil and connecting with nature one-on-one is a deeply personal way to connect with your primal self. It wasn't that long ago that our ancestors grew their own food. (They had to or they didn't eat!) In my family, it was only two generations back that my grandparents had a farm in Arkansas where they raised animals and grew their own produce. Actual homesteading! When the Great Depression hit, they were barely phased because they were completely self-sufficient. How quickly things have changed. We need to get back to our roots and find ourselves "rooted" in the earth once more. I could write an entire book on how gardening has enriched my life and led me safely through some tough times with anxiety and depression. If you suffer with mental health issues or just feel disconnected from yourself, I'm telling you with all honesty that you will find what you are looking for in the garden. And knowing that you're not applying chemicals and are doing good for the planet will bring you another level of peace.



## **ORGANIC GARDENING: A CAREFUL AND THOUGHTFUL STEWARDSHIP OF THE LAND**

When most people think of organic gardening, they might think it means not using poison to kill bugs or weeds, but it's actually more than that. It's about following an important set of principles to ensure your garden will be healthful and bountiful, but also an ecosystem that is beneficial to the creatures that inhabit it.



*Organic gardening creates a thriving ecosystem in your backyard. These amazing tomatoes were grown simply by planting carrots and basil in the same proximity, which helped repel insects that otherwise could have destroyed the tomatoes.*

## **PROTECTING THE LAND**

A garden isn't just inhabited by plants; it's inhabited by a broad spectrum of creatures that interact with each other, and they each have a significant impact on how a garden will thrive or fail. Organic gardening restores at least our small portion of the planet as a haven for wildlife to thrive. I consider my garden not only a refuge for myself and

my family, but for Boomer (our lazy little terrier), and for our chickens, fish, and birds, as well as the millions of insects and microscopic soil organisms that call our humble property home. Organic gardening takes into account the biodiversity around us and how each piece plays a role in keeping the garden, and the earth, in balance and working in harmony.

## WORKING IN HARMONY WITH NATURE

Like many other conventional gardeners, I grew up thinking nature needed to be reined in and tamed in order to grow food successfully; I thought the gardener needed to keep an armory of poisons at the ready to thwart the attack of any bug. Almost every day, through my social media channels, the mere mention of “I have this bug on my tomatoes, cabbage, lettuce, etc.” is an invitation for countless responses on the best way to kill it. As gardeners, we should always first determine if the insect is even harmful to our plants, because it could be that it’s there to help us do our jobs as gardeners. Bugs kill each other all the time; it’s the circle of life, and more often than not, *we* are disrupting that circle greatly. Spraying pesticides (even organic options) can perpetuate the downward spiral of the delicate ecosystems in our own gardens. It’s much easier and much more satisfying to work *with* nature and not be at odds with it.

## THE FIVE PRINCIPLES OF ORGANIC GARDENING

There are five widely accepted principles of organic gardening that enable us, as gardeners, to assist nature without the need to control it.

### **1: Nourish the Soil**

Soil is so much more than a planting medium to keep roots anchored and plants standing upright. It’s a living, breathing community of life, and not just for the earthworms and other creepy crawlies you see, but for trillions of microorganisms and fungi that science is still discovering and learning about. Organic gardening is about feeding the soil, and not

just the plants that are growing in it. This is done with organic fertilizers and compost and even planting the right companion plants.

## **2: Create Your Own Compost**

Homemade compost is the single best soil amendment you can use in your garden: it feeds the soil life, and in turn the soil life helps feed your plants. A thick layer of compost added once or twice a year will give your garden what it needs. (I'll show you how to make your own compost in [Getting Your Garden Started](#).)

## **3: Plant the Right Plants in the Right Locations**

Just like people, plants have requirements, and some plants have requirements that are different from those of the next plant. If you place the wrong plant in the wrong location, it may not die, but it will never thrive. But if you move that same plant to the right location, you'll see the change within days. It will look like a new plant.

## **4: Use Nonchemical Pest and Disease-Control Methods**

This begins with healthy soil and plants being planted in the right locations so they can thrive. A healthy plant is a pest-resistant plant! Pests will attack the weakest plants in the garden, so if you don't give pests weak plants to feed on, you will have fewer pest problems. That being said, you *will* get pests. It's a fact. But organic solutions like hand picking, companion planting, crop rotation, and organic pesticides like Bt, neem-oil, and insecticidal soaps and oils will help your cause.

## **5: Treat the Garden as a Single Living Organism**

Holistic medicine looks at the body as a whole, with the belief that every last cell in the body works in harmony with the others, and organic gardening aligns with this belief. Organic gardening takes into account the smallest microbes in the soil and how they have just as much to do with the health and well-being of the garden as the earthworms, ladybugs, plants, and even the gardener. In fact, it's the organic gardener's responsibility to protect nature's delicate balance and keep it from tipping too far one way or another. Sometimes that role is

as simple as making sure the right mix of plants are in the garden and then just taking a step back and watching with amazement what nature can do!



## THE PRINCIPLES OF COMPANION PLANTING

In its simplest form, companion planting and, in my opinion, *true* organic gardening are the emulation of nature. When you follow these principles, your garden will thrive in ways you never thought possible. On top of that, your garden will grow and flourish and with much less time and labor from you!



### **Practice Polycropping**

You don't see rows of any kind in nature. You also don't see huge expanses of any one type of plant surrounded by nothing else. Nature is diverse. When you look at a forest, you first might see only pine trees, but the forest floor is covered in ferns, columbine, wild berries, asters, goldenrod, wild geranium, and so on, and all of those plants serve a purpose in that forest. Companion planting follows the same principle and is about developing a diverse growing environment where plants and organisms work in harmony.

When you look at most of today's farms, you'll see miles of a single crop in a field. This practice is called *monocropping* or *monoculture*, and it creates a very exclusive club for one type of plant, but it also creates problems for pest management. Monoculture is a beacon for pests like cabbage white butterflies to find an unlimited buffet of their favorite foods. What we're aiming for in our garden is creating diversity by growing two or more different crops together, which is called *polycropping* or *polyculture*. Intermixing different kinds of crops confuses pests and makes it much harder for them to find their favorite plants. It means pests can't simply hop to the next plant in the row; they have to begin the search all over again after they're done feasting on a plant.

### **Use Crop Rotation**

Plants have certain pests that love them and only them. There are also pests and pathogens in the soil that can cause disease, and these also happen to prefer just one type of plant, which means they can overwinter in the soil and be ready to attack when the same plant is grown in the same location in the spring. By using crop rotation, you'll change planting locations each growing season and mix it up year after year, so each bed will grow something different, and those pest and pathogens won't be able to thrive.

### **Interplant Flowers, Herbs, and Perennials**

Yes, flowers, herbs, and even perennials have their place in the organic vegetable garden. Not only do they have their place, they should be on full display! This is good news for us gardeners because it creates a more colorful and attractive garden space. It's also great news for our vegetables because these colorful beacons can also attract beneficial insects. If you grow the right types of flowers, herbs, and perennials in your vegetable garden, they will attract all kinds of "good" bugs that will help you keep the "bad" bugs under control.

### **Use Plants That Create a No-Dig Garden**

One of the things that keeps people from starting a garden is the thought of preparing the soil every year, especially if they don't have a

rototiller and instead have to resort to the backbreaking labor of digging the soil to prepare the ground. Using plants that naturally loosen and work the soil will eliminate a lot of that backbreaking work.

### **Use Living Mulches and Allelopathy to Control Weeds**

Growing specific plants in and around your crops will keep weeds at bay and also help the soil retain precious moisture. There are even certain plants that act as herbicides and keep weed seeds from germinating, a process known as *allelopathy*.

### **Grow a Broad Variety of Flowers to Attract a Broad Variety of Pollinators**

Flowers attract critical pollinators like bees, hoverflies, butterflies, and more. But not all of these bugs are created the same way, and they all have different mouth shapes, different ways of eating, and even different diets. Planting a variety of flower shapes will help attract a diverse range of pollinators into your garden.





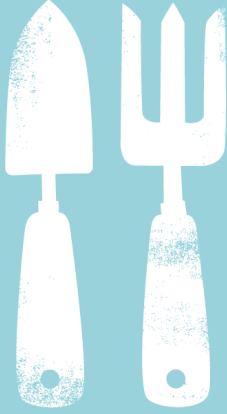


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## CHAPTER 2

# GETTING YOUR GARDEN STARTED

**CHOOSING A GARDEN LOCATION**

**DETERMINING WHEN TO PLANT YOUR GARDEN**

**EVALUATING SUN REQUIREMENTS AND EXPOSURE**

**STARTING AN IN-GROUND GARDEN**

**STARTING A RAISED-BED GARDEN**

**STARTING A CONTAINER GARDEN**

**WARM SEASON AND COOL SEASON CROPS**

**SELECTING SEEDS**

**STARTING SEEDS**

**GROWING AND TRANSPLANTING SEEDLINGS**

**ALL ABOUT COMPOST**

**MAKING YOUR OWN COMPOST**



## CHOOSING A GARDEN LOCATION

There are lots of factors to consider when planning a new garden, but placement should be at the top of the list. An improperly placed garden can create more work and frustration for you, and also keep your plants from thriving. A properly placed garden, however, will create a thriving growing environment where your vegetables will flourish, and you'll also be doing less work.



## CHOOSE A CONVENIENT LOCATION

The most basic need to consider when choosing a garden location is convenience. Look for a location that is close to both your home, and, more importantly, your kitchen. After all, we're talking about vegetables and herbs, so it's important to have them growing near the house where you can easily run out and select what you need. If this just isn't

possible, select a location close to your home that will at least make it easier to collect ingredients for cooking, particularly in bad weather. Also, your garden should be placed on flat ground or ground with a very gentle slope; this will help avoid cold spots and also aid watering, as runoff won't be a big issue.

## **SEEK OUT THE SUN**

In order to thrive and produce as expected, most vegetables need lots of sun, so the sunnier the location, the better. Ideally, a garden location should provide vegetables with eight or more hours of sun each day, and a minimum of six hours per day. Note that the hours do not need to be consecutive; if the plants receive two hours in the morning and four hours in the afternoon, that will still work.

## **BEGIN WITH GOOD SOIL**

The foundation of any good garden begins with the soil. Whether you're planning a new garden or working with an existing one, it's good to remember the old adage: it's better to plant a one-dollar plant in a ten-dollar hole, than to plant a ten-dollar plant in a one-dollar hole. In other words, a smaller plant will do much better in good soil than a larger plant will do in poor soil. There are many soil factors to consider, and some you will be able to control, while others may be beyond your control.

## **FACTOR IN THE COLD**

If your location has long cold winters, where you place your garden can have an impact on the length of your growing season. Cold air sinks, so you don't want to situate your garden at the bottom of a slope or in a low spot on your property; these will be the coldest spots, and these cold pockets will collect cold air and increase the likelihood of lingering frosts. Placing your garden in a higher spot will allow cold air to migrate away from the area, warming the garden earlier in spring and extending the growing season in fall. For more tender plants, you can situate them next to a south-facing wall (or a north-facing wall in the



Southern Hemisphere), and the wall will absorb the heat during the day and radiate it out to the plants at night.

## **CREATE WINDBREAKS**

If your location gets lots of wind, it's important to provide some kind of protection in the form of a wall, fence, hedge, or row of trees. These windbreaks can protect your plants from windburn or being blown over or battered. They can also protect the soil from being dried by winds. Just be sure to keep an eye on the shadows these windbreaks create; you want the wind protection they provide, but you don't want them to shade the garden to the point where the plants aren't getting the sunshine they need.

## **HAVE GOOD ACCESS TO WATER**

It's important to consider access to a convenient water source when planning the placement of your garden; nothing will tire you out faster than lugging water back and forth to the garden. Also, keep in mind that gardens near large trees will have to compete with the trees for water, so it's best to locate your garden in an open area and away from any trees that might be drinking up hundreds of gallons of water each day.

## **CREATE PATHS FOR ACCESS**

Garden paths between beds should be at least 2 feet (0.5 m) wide to allow for kneeling between the beds and also wide enough that you can face the beds directly, instead of working at an awkward angle. You should also consider if you will need to get a wheelbarrow through your paths for mulching, composting, and so on. If you are in a wheelchair, I suggest you mark out paths that factor in the width of your wheelchair, especially on the turns.

## Does Bed Direction Matter?



A common question many gardeners have relates to which direction beds should face, and if bed direction even matters. The typical answer is that beds and rows should run north to south, and while this might be true for farms practicing mono-culture, I don't think it matters for companion planting. What does matter is that you place taller crops where they won't shade lower-growing crops. For example, in the Northern Hemisphere you would place a taller crop, like corn, to the north of a smaller crop, like lettuce, because the sunlight is coming from the south, and you'll want it to reach both plants so they can get the full advantage of the sun's rays for as much of the day as possible.

## DETERMINING WHEN TO PLANT YOUR GARDEN

Before you ever plant a seed in your garden, you'll need to figure out when it's safe to plant, which plants will grow in your area, how long it will take for those plants to mature, and when the growing season for your area will come to an end.

## UNDERSTANDING GROWING ZONES

Growing, or *hardiness*, zones will determine what perennial plants, trees, and shrubs will survive through your winter. There are 11 growing zones in the United States, and each growing zone is 10°F (12°C) warmer or colder in an average winter than the zone above or below it. However, because most vegetables are not perennial, growing zones don't really matter—the vegetables grow for a season, produce, and die. But there are exceptions: asparagus, artichoke, rhubarb, sweet potatoes, and strawberries, as well as many fruit trees and berry varieties are all perennials and will come back year after year. For these plants, you'll need to know your growing zone so you can decide if you should plant them in your area. (Whether you are located inside or outside of the United States, you can go to my website to find links that will help you determine your growing zone.)



## **FACTORING IN AVERAGE FIRST AND LAST FROST DATES**

In order to grow most vegetables, you will need to know the first and last average frost dates for your growing area. These dates, which are compiled from historical weather data for your area, will tell you, generally speaking, when it is safe to plant (last frost date) and when frost is likely to kill off your garden plants (first frost date). Your last average frost date is always early in the calendar year, and your first frost date is always late in the calendar year. It's important to keep in mind that these dates are averages and should only be considered as general guides, because every area is a little different from the next. For instance, the last average first frost date for my general area is

December 20, and the average last frost date is February 14. However, we rarely get frost where my home is located—maybe just a couple of nights each year, and even then it is very light. It all depends on where you live. If you live in a very mild winter climate, your frost dates might be listed as “infrequent” or “no frost,” so your planting window will be much larger. If you live in a truly tropical climate, you won’t have cool and warm seasons, and will be able to plant almost anything at any time.



## **DETERMINING WHEN TO PLANT**

You can use your average last frost date to determine when to start seeds indoors or outdoors. Most seed packages will list how soon before your



average last frost date you can start seeds indoors, and they will also tell you when it's safe to plant the seedlings in the garden. The package should also list the *days to maturity* or *days to harvest*, which is helpful if you have a short growing season or are planting a late summer-fall garden, and you need to determine if you have time to get a harvest before the frost comes and kills off your plants. For example, if a packet says you can sow seeds indoors six weeks before your average first frost date, and your average last frost date is February 14, you can start your seeds indoors around the beginning of January, and by February 14, your seedlings should be ready to be planted outdoors. However, keep in mind that the February 14 date is just an average based on historical weather data, so when that date arrives, you will still need to check the weather forecast to determine if there is cold weather coming, in which case you would need to keep the seedlings indoors for a little longer. In a short growing season climate, or for a late summer-fall garden, the *first* frost date is the most important one to know. If the first frost date is November 1, you'll need to look at the seed packet to see how many days to maturity or days to harvest is listed for the plant. If a crop has 60 days to maturity, you'll need to count backward from the first frost date of November 1 to determine when to start the seeds. In this case, you would start your seeds no later than September 1 to allow enough time for the plant to grow and produce before the first frost comes.



## EVALUATING SUN REQUIREMENTS AND EXPOSURE

Sunlight is something we all live with every day, but it might just be one of the most confusing factors for new gardeners to understand and even for not-so-new gardeners to understand if they've never taken the time to evaluate how it falls on their garden at different points of the day or year. Sun exposure is ever changing, and in some spots in your garden, the sun exposure might change from hour to hour, month to month, and season to season.

### EVALUATING SUN REQUIREMENTS FOR YOUR VEGETABLES

When you buy a packet of seeds or a transplant in a container, the sun requirements should be listed either in word or picture form on the packaging or container. But how do those needs translate into your garden? Here are some guidelines for determining how to use those requirements.



#### **Full Sun**

*Full sun* on a package doesn't mean the plant will need full exposure from sunup to sundown. It means the plant will need six to eight hours of full sun exposure each day. If your garden has that level of exposure, you shouldn't ever have to give a second thought to the sun requirements for most of your vegetables.



#### **Partial Shade or Partial Sun**

These terms can be used interchangeably to mean four to six hours of direct sun. *Partial shade* usually means that morning sun exposure is preferred, with shelter from the hotter, midday and afternoon sun, while *partial sun* means morning shade is preferred, followed by exposure to hot midday or afternoon sun.





### Full Shade

*Full shade* is defined as an area receiving less than four hours of direct sunlight per day. This can be further broken down into *deep shade*, which is an area with no direct sunlight whatsoever, and then there is *dappled shade* under a deciduous tree, where light will filter in but there is very little direct sunlight.



## CREATING A SUN MAP

The easiest way to figure out your garden's sun exposure is to create a sun map that tracks the sun's travel across your property. To make a sun map, you'll need five sheets of paper (preferably graph paper) and a pencil. Draw out a rough map of your property on each sheet of paper, including the house and any perimeter walls, fences, and trees (including those on neighboring properties), as well as any other immovable objects that may cast shade. This map doesn't have to be fancy, but try to be as precise as you can about object lengths and distances. You'll go out to the garden four times during a sunny day, beginning at 9 a.m., and then every three hours thereafter at 12 p.m., 3 p.m., and 6 p.m. On each piece of paper, fill in two different colors: one to show where the sun is and one to show where the shade is, and then

compare all four maps to create a final map that takes into account all of the data. Full sun is considered six or more hours, so if the sun appears in three or more maps, that is a span of six or more hours and is considered full sun. If only two of the maps show sun, that is a time frame of four to six hours, so that area is partial sun or partial shade. If only one or none of the maps show sun, that area is full shade. You can then use the map to situate your garden in a spot that is in full sun, or as much sun as possible and reserve the other areas for vegetables and ornamentals that enjoy part shade or shade. Some aspects of sun exposure can be controlled and some cannot. Trees that cast shade on your garden can be trimmed, thinned, or cut down completely, but a neighbor's trees can't be controlled. A 6-foot fence doesn't cast much shade in the height of summer, but in winter that shadow can be over 10 feet (3 m) long. An area under a deciduous tree can be classified as part, or even full sun in fall and winter; whereas in the spring and summer, when it's fully leafed out, it can be classified as shady.

Try to repeat this exercise for every season in your garden. (If you have a really short growing season, one map in the middle of the summer season should suffice.) If you can garden in all four seasons, you should do this four times, preferably in the middle of each season. It will take some work, but once you've done it, it will never change unless, of course, a tree grows or a structure is built that blocks sunlight.





## Partial-Shade Vegetables

There are very few vegetables that will thrive in partial shade, and none that will thrive in full shade; however, you can still grow some vegetables that will tolerate partial shade (four to six hours of sun):

- Leafy greens like lettuce, cilantro, arugula, chard, kale, spinach, and Asian greens (some of these will grow even with some sun protection in warmer months)
- Asparagus
- Root vegetables like beets, carrots, parsnips, potatoes, turnips, and radish
- Brassicas like cabbage, cauliflower, broccoli, brussels sprouts, and kohlrabi
- Green onions and leeks



Note that these plants won't produce like they would in full sun, and they will take longer to mature, but you will still get a harvest.

## STARTING AN IN-GROUND GARDEN

An in-ground garden is the simplest and most popular. Here are some benefits to this type of garden, as well as some potential issues you might encounter and some tips on how to handle them.



## BENEFITS

There are several benefits to choosing an in-ground option.

- **Cost:** It's much less expensive than a raised-bed garden because there is no construction, and the soil is already in place.
- **Less work:** Initially, an in-ground garden is less work than a raised-bed option because there is no construction and you don't have to bring in truckloads of new soil.

- **Less water:** In most cases, gardening directly in the ground requires less watering because the garden patch is insulated by the surrounding soil and benefits from the soil depth.

## **DRAWBACKS**

There are some drawbacks to in-ground gardening.

- **Drainage:** Depending on the soil composition, it can be more difficult to control drainage—this is especially true if the soil is trampled frequently, and it can take much longer for in-ground gardens to warm up and dry out in spring.
- **Weeds:** In-ground gardens tend to have many more weeds compared to raised-bed gardens.
- **Soil amendments:** You will still need to add organic matter and make soil amendments for drainage, as well as amending the soil pH.

## **PREPARING AN IN-GROUND GARDEN SPACE**

Once you've evaluated the location for sunlight and mapped out your space, you'll need to choose a method for installing your in-ground garden.

### **The Build-Up Method**

The build-up method is the easiest method to implement, and will also be the easiest on your back. Once you've figured out the placement, you'll need to prepare the bed. If you're planting in bare soil, you can simply put down a 6-inch (15 cm) layer of compost directly on top of the bare soil and then plant into it immediately—it doesn't even need a border.

If your bed is going to be placed over existing lawn or weeds, however, you should first mow the area as short as possible, and then put down a layer of uncoated, corrugated cardboard to help smother the weeds and lawn. The cardboard will break down eventually and be incorporated into the soil, by which time most, if not all, of the lawn and weeds will be eliminated. You can then add a layer of compost right on top of the



cardboard, and you'll be ready to plant. (Note that you should never use colored or coated cardboard, only the plain [brown] corrugated type, and you'll need to remove any staples or tape.)

### **The Dig-Down Method**

If you choose the dig-down method, you're in for some work, but it is satisfying work! The first step for using the dig-down method to prepare a bed for long-term planting is to use a long-handled, round-point shovel to remove any weeds or lawn grass. It can be difficult to remove every last piece from lawns that spread by runners and perennial weeds, like dandelions. Any remaining fragments will grow new plants, so it will take some effort to ensure you've removed everything. If you have the time or aren't able to do the digging, you can solarize the soil by spreading black plastic over the area, weighing it down, and leaving it in place for two to three months in the summer sun, or about six months in the winter. It does require a good amount of time and patience, but the heat will eventually kill the weeds.

Once you feel you have a relatively weed-free area, dig the soil as deep as the shovel (usually about 10 to 12 inches [25 to 31 cm]). Once you reach that depth, turn over the entire area and then add 3 inches (8 cm) of compost over the area and turn it again, thoroughly breaking up any clods while mixing the mulch into the soil and removing any remaining weed roots and runners. If you have heavy clay soil, you can mix in gypsum (about 1 pound for every 5 square feet). Once you've prepared the soil, rake the area flat. After planting, add 2 to 3 inches (5 to 8 cm) of mulch to help keep down any weeds you may have missed in the process.

With any in-ground planting, be aware that you may have underground pests such as gophers, voles, moles, and ground squirrels that are just waiting for a tasty underground snack. If you have these pests in your garden, placing a layer of gopher wire or galvanized hardware cloth 6 to 8 inches (15 to 21 cm) below the surface will create a physical barrier between your crops and these destructive pests.

## **Planting**

Once you've prepared the beds, it's time to plant. I recommend staying away from planting long rows. Instead, set up the area with narrow beds that are maybe 4 feet wide and 6 to 10 feet long. This setup will allow for better planting of groups of crops with companion plants. A 4-foot-wide (1.25 m) bed will allow most people to reach into the middle of the bed without actually stepping into the bed.

## STARTING A RAISED-BED GARDEN

I'm going to state up front that I am biased: I love gardening in raised beds! While I think there are a few short-term drawbacks to the raised-bed option, in my opinion it's the ideal option over the long term.



## BENEFITS

- **Less compaction:** Raised beds reduce soil compaction and the likelihood of plants getting squished by people or animals who don't stick to paths.
- **Longer growing season:** Raised beds warm up more quickly in the spring and, assuming the soil is properly prepared, drain better to allow for a longer growing season and better growing conditions.

- **Less weeding:** There's no tilling because there's no compaction. As time goes on and weeds are kept at bay, fewer weeds will grow.
- **Better drainage:** If you use a good growing medium in your raised bed, the soil will drain better than it will in an in-ground garden.
- **Cheaper (in the long run):** Because the gardening space is concentrated and well defined, the application of water, fertilizer, soil amendments, and mulch can be better controlled.
- **Safer:** Raised beds are great for people with bad backs or disabilities. The higher the raised bed, the less leaning over you will have to do. This can greatly reduce the strain on your back after long days in the garden. It can also provide great access for wheelchairs, provided the path size and turns are appropriately planned.
- **Higher plant concentration:** Because of great drainage and a deep root run, you can plant vegetables more intensively and closer together; therefore, you'll be able to grow more crops in a smaller space.

## DRAWBACKS

There are some drawbacks to the raised-bed option.

- **Cost:** It costs a fair amount of money to build the beds and fill them. Each of my beds required a little less than \$100 in materials, and I provided the labor, but you can build them less expensively. The real money comes in filling the beds with a good planting mix. Unless you have a light loam garden soil, you shouldn't just fill raised beds with garden soil. Garden soil will compact and will not give the full benefit of a raised bed. Even if it's light loam, I would still add 50 percent organic matter.
- **Maintenance:** After the bed is set up, the plants will be 100 percent dependent on you to provide water and ongoing additional nutrients. They can't send roots deeper or wider until they find water and nutrients, so you'll need to be a diligent gardener with this bed option. Also, if your raised beds are open to the soil beneath and you have

gophers or similar pests, adding a barrier between the raised bed soil and the ground soil will be important.

## PREPARING A RAISED-BED GARDEN SPACE

When deciding the height of your raised beds, consider first what your raised beds will be sitting on. If they are open to decent soil underneath, building them 6 to 8 inches (15 to 21 cm) high should be sufficient. If they are built over concrete or poor soil, however, you'll want to make them between 15 and 24 inches (38 to 61 cm) tall. The taller the raised bed, the easier it will be to access it, and the more room roots will have to spread out. (Mine are 15 inches tall, and if I had it to do over again, I would make them 24 inches tall.)

In my opinion, neither in-ground nor raised-bed gardens should be walked in, so you'll want to plan the beds so they can be easily accessed from all sides. If you are building raised beds for comfort or a disability, first set up some objects at different heights. Work around and over them to determine what height is most comfortable for you. This will help determine how high you should build your beds. As for width, some people with longer arms can reach across a 5-foot-wide bed, but for most people, 4 feet should be a good width to comfortably reach the center from either side.



### **Building on Difficult Areas**

There are times when planting in raised beds is a necessity. In my garden, there is bare soil here and there, but it's almost all in shady areas. The one spot that had full sun was on a large 20' x 20' cement slab. I could have broken up the slab and had it hauled off, but that would have been backbreaking work, and also cost a lot of money, so I decided I would build raised beds on top of the slab. If you have a similar scenario, or if your soil is contaminated, or really sandy or hard clay, raised beds are a good option.



## STARTING A CONTAINER GARDEN

Container gardening is a very popular way of growing vegetables, and rightly so. Containers give you so much flexibility in the garden. You can grow plants in places that poor soil otherwise wouldn't allow, and they don't require the work or expense of building a raised bed.



## CHOOSING CONTAINERS

Containers can be made of almost anything, so you can get creative. As long as it has drainage holes, really anything will work. There are a few basics you'll need to know to be successful, as container gardening does have a few challenges.



As a general rule, the bigger the plant, the bigger the container; and the bigger the container, the easier it is on you. You never want a plant to become *root-bound*. That's when you remove the plant from the container and all you see is roots and very little soil. The roots will swirl around the outside of the root ball to the point where they are in contact with the pot. This isn't a good thing; it will starve the plant of nutrients since the roots literally have nowhere to go to get water and nutrients, unless you provide them. The smaller the container, the faster water and nutrients will disappear, so a larger container will mean less work for you.

## **CHOOSING SOIL**

The soil you use in your container is very important. You don't want to use garden soil: it can compact in containers and won't drain, even with the addition of perlite (a naturally occurring substance that is added to potting soil to improve the soil structure). You'll want to use a completely broken-down, homemade compost with about 25 percent perlite added for drainage. You can also buy bagged organic potting mix, which is a soilless mixture that retains moisture and won't compact.

## **WATERING AND FERTILIZING**

In containers, watering is essential, and daily watering may be necessary depending on the size of the container, weather conditions, and how many roots have filled the pot. Drip irrigation is especially helpful for containers because, if you're like me, you either forget to water every day or simply don't have the time to water daily. You should fertilize your containers weekly with a general liquid organic fertilizer.



## Safer Choices for Plastic Containers

Plastic pots are cheap and readily available, so they're a very attractive option when it comes to container gardening. However, not all plastics are created equal. Light and heat can cause some plastics to leach their compounds into the soil and eventually into your food.

Fortunately, there is an easy way to determine which plastic containers are safe to use. Every plastic container should include a recycle logo with a number somewhere on the bottom. You should only use containers that have a "2 (HDPE)" or a "4 (LDPE)" stamped on the bottom. HDPE (*high-density polyethylene*) and LDPE (*low-density polyethylene*) are both petroleum-based plastics, but there's generally no leaching of chemicals when these plastics are exposed to temperature extremes, and both are also UV-resistant. Containers made from either of these materials are excellent, safe choices for vegetable gardening. Containers with a "5 (PP)" stamped on the bottom are a generally safe second option. PP, which stands for *polypropylene*, doesn't handle temperature extremes as well as HDPE or LDPE, but it's generally considered safe for vegetable gardening. You should avoid using any other plastics for your containers.



## **WARM SEASON AND COOL SEASON CROPS**

Every gardener knows the difference between the cool season and the warm season. However, it's important to know when these seasons begin and end, which crops are best grown in each season, and when it's best to plant and harvest in each season.

### **COOL SEASON CROPS**

Cool season crops mature when the weather is cool, which is in spring in most climates and in winter in some milder climates. In colder climates, there are actually two cool seasons each year: fall and spring. You can start seeds in late summer for a fall harvest, and you can get seeds started indoors in late winter for a spring harvest.

In milder winter climates like mine, frosts are few or even nonexistent, and there is only one long cool season—it starts in late fall and runs through spring. In my climate, I can start seeds of cool season crops in late summer or early fall, continue starting seeds all the way through early spring, and harvest all the way through early spring, as well. There is actually a much larger variety of crops I can grow in the cool season compared to the warm season.

## COOL SEASON CROPS

Artichoke	Endive	Onions
Asparagus	Escarole	Pak choi
Beets	Fava beans	Parsley
Bok choi	(broadbeans)	Parsnips
Broccoli	Fennel	Peas
Brussels sprouts	Garlic	Radicchio
Cabbage	Green onions	Radishes
Carrots	Horseradish	Rhubarb
Cauliflower	Kale	Rutabagas
Celeriac	Kohlrabi	Shallots
Celery	Leeks	Spinach
Chard	Lettuce	Swiss chard
Chickpeas	Mustard	Turnips
Chives	Napa cabbage	Watercress







## WARM SEASON CROPS

The warm season is fairly similar across most climates. Warm season crops mature when the season is warm, which is summer in most climates and also fall in some climates with longer growing seasons.

For warm season crops to mature in summer, they need to be started in spring. In some milder climates, that could mean sowing seeds outdoors in March or April. For climates with longer, colder winters, this could mean starting seeds indoors in March or April so they are ready to put into the garden in May, or even June, to give them a head start and to make the most of a shorter season. Interestingly, most people only garden for summer. If that is the case, they might be leaving a huge assortment of crops completely off the table—literally! I invite you to make the most of your gardening year, however long or short it is.

To prepare for growing either type of crop, you'll first need to determine your first and last frost dates. Whether you have a long growing season or a short growing season, you can extend the time you have to get a harvest by starting seeds indoors when it's still frosty or even snowing outside.

### WARM SEASON CROPS

Beans	Melons	Summer squash
Corn	Okra	Sweet potatoes
Cowpeas	Peppers	Tomatoes
Cucumbers	Pumpkins	Winter squash
Eggplant	Soybeans	Zucchini



## **SELECTING SEEDS**

I have four favorite days of the gardening year: the day the big heirloom seed catalog comes in the mail, the day the seed order comes in the mail, the day I sow the seeds, and the day those first tiny seedlings poke their heads out of the soil. I think a lot of gardeners can relate to this. There is nothing I'd rather do on a cold, rainy winter day than sit in front of the fireplace with a seed catalog, dreaming about the upcoming spring. I love seeds. I love the promise of what a seed represents, and marvel at the miracle that a seed is. A seed represents hope and faith. Hope that no matter how dark and cold the winter, there will be sunshine and green again. It also requires some faith to put your trust in what looks like a small stone or flake of pepper, and go through the actions of sowing, watering, and caring for these seemingly inanimate bits of nothing. But then a week or two later, that faith and trust is rewarded with a carpet of bright green leaves floating above what was a blank canvas of brown. Seeds truly are little miracles in action. Each and every seed, no matter how tiny, has every bit of information in it to germinate, grow roots and leaves, and given the ideal circumstances, grow into what it is meant to be. Maybe it will be a tomato plant, here one season and gone the next, or maybe a giant sequoia that will live for a thousand years.



## SEED TYPES

Before we delve into starting vegetables from seed, we should talk about seed types. There are four different types: GMO, hybrid, open pollinated, and heirloom.

### **GMO**

Let's escort the big ugly elephant out of the room right up front: GMO seeds are not created through natural processes and do not occur in nature. They are created in labs by inserting specific genes from one organism directly into the genetic information of a plant. These genes may come from completely different organisms that would never naturally cross with the plant—from bacteria, for example. I'm not going to get into the good and bad of GMOs or the moral or health implications that may or may not be associated with changing plants in this way, but what I will tell you is that as a home gardener you have zero chance of sowing a GMO seed. When you see "GMO-free" labeling on a seed packet, it's accurate, but GMO seeds cannot be sold to



home gardeners, nor could most home gardeners afford them. GMO companies like Monsanto keep tight control on their seeds and sell them to commercial farmers for huge money. So you can rest assured that you're not unknowingly growing these in your garden.

### **Hybrid**

While “hybrid” might sound like some scary mutant creature from an alien planet, it isn't scary at all. Hybrid seeds are simply the result of one plant's pollen—let's say a tomato's—reaching another tomato flower variety and pollinating it. This is done every day in your garden by bees and the wind, and it's also done by plant hybridizers who wear overalls and use little paintbrushes to aid the pollination process, which is much different than the scientists in lab coats who use needles and microscopes to create GMOs.

When you cross-pollinate two tomato varieties in a controlled environment, you get the direct offspring, which is an F1 hybrid, meaning it's a first generation hybrid. My favorite cherry tomato, Sungold, is an F1 hybrid, but if I save the seeds from a Sungold tomato, those seeds will not produce a true Sungold tomato plant. The characteristics would be similar to one or both of the parent plants, but any plants produced from F1 hybrid seeds will not be first generation and are generally weak due to inbreeding. Also, while some hybrid varieties are outstanding and are bred for flavor, hybridization is also the reason grocery store tomatoes taste flat. Those tomatoes are not bred for taste. They are bred for shape, color, fast growth, and their ability to be transported over long distances without spoiling.

### **Open Pollinated**

Open-pollinated seeds are pollinated by nature: insects, wind, and birds. These seeds will grow *true to type*, which means that if you protect them from being cross pollinated by other varieties, you can collect and save the seeds. The plants that grow from them the next year will be very similar to, and maintain the same characteristics as, the parent plant that you collected them from.



**Heirloom**

To be considered an heirloom, a seed variety must be in existence for 50 to 100 years. (This actual number is up for debate.) Heirloom tomatoes must be open-pollinated, but not all open-pollinated plants are heirlooms. In essence, they are varieties that have been passed down from generation to generation.

## Is It Okay to Grow Seeds That Aren't Organic?



Yes! Some seed companies may claim that because their seeds are grown organically, the seeds will produce healthier plants already adapted to growing well in organic conditions, but being grown organically for a few years does not change actual seed genetics. I grow organic seeds when I can get them, and they are my first choice because I want to support organic farmers, but if I'm looking for a specific variety, and all I can find is nonorganic, I'm still going to get it!

## STARTING SEEDS

Once you've ordered your seeds, you'll need to decide how you are going to start them. There are a few ways you can do this and which option you choose will depend on several factors.



## GROWING SEASON

If you live in a mild winter climate with an early or nonexistent average last frost date, you can start your seeds outdoors, directly in the location where they will be growing. Or, if your beds are already full of cool season crops that aren't finished producing, you can sow the seeds outdoors in seed-starting containers. If you want to maximize a shorter growing season, check the seed packet to see how soon you can start them indoors before your last frost date. It's usually six weeks.

## **GROWING MEDIUM**

To start seeds indoors, there are a few things you'll need to be aware of. First, you should sow your seeds in something other than regular garden soil. Well-amended garden soil is fine for direct sowing in the ground, but when you are asking a seed to germinate in a tiny container or cell, you need moisture retention but also great drainage, which garden soil can't provide. Additionally, using garden soil can bring creepy crawlies indoors that you probably would rather stay outdoors. You can use any sterile indoor potting mix. Garden centers also sell seed-starting mix, although I think it's overpriced and not worth the cost.

## Peat Moss and Sustainability



In many parts of the world, and Europe, in particular, the use of peat moss is banned because there has been such a prevalence of overfarming that the peat bogs are in danger of disappearing. In North America, however, we're not quite in that situation. Canada has vast peat bogs and, as far as my research can tell, they're doing a very good job of not overfarming them. It takes about 1,000 years for farmed peat to be replenished once it's farmed, but because Canada's peat bogs are so large, and the amount they farm is comparatively very small, the peat bogs are actually producing more peat every year than the amount being farmed. So generally speaking, it's a sustainable option. That being said, I still only use peat products for seed starting and indoor plants, and I never use it in my garden beds.

If you're in Europe or some other location where peat is in dangerous decline, a good second choice would be *coco coir*, which basically is the fuzzy skin of a coconut that's been ground up. You can order it online, and it comes in a compressed brick that, when soaked in water, will break apart and expand to many times its original size.

## CHOOSING A CONTAINER AND SOWING METHOD

The vessel you sow your seeds in will dictate, more or less, which method of sowing you will be using. If you are using a flat restaurant-takeout container, half a milk carton, or something similar, you will be *broadcast sowing*. With the broadcast sowing method, you'll sprinkle the seeds across the surface of a potting mix and then thin, or *prick*, them out later, and then transplant them into their own cells for growing.

If you are using modules, peat pellets, reused six-pack garden center containers, or purchased cell trays, most likely you will be *station sowing*, which means you'll sow one or two seeds per station, and then leave them in the stations to grow.





*Broadcast sowing seeds*



*Station sowing seeds*

## Using Peat Pellets

Peat pellets are another great choice for starting seeds. They're small, flat, super-compressed disks of peat, surrounded by netting to help them hold their shapes. When you soak peat pellets in water, they expand to many times their size. They come in a smaller size (30 mm) and a larger size (50 mm), but I suggest using the larger size, especially if your seedlings will be growing in the pellets longer than three weeks before planting out. When they are ready to be planted out, you can just pop the seed starts and pellets directly into the ground. The plants will barely they have been transplanted, placing less stress on the plants and making it easier for them to adjust to garden life from indoor life. The netting around the pellets is supposedly biodegradable, but it might take more than one season for the netting to disintegrate, so while it's not a necessity to remove the netting, particularly if there are a lot of roots already growing through it, I still like to remove it before planting out whenever possible. Note that peat pellets can become top heavy and may have a difficult time standing upright. To prevent them from tipping over, place them side by side in a container like a plastic box. This will help keep them secure and upright, and will also help retain moisture around the sides of the expanded pellets. Note that you'll want to create some holes in the bottom of the container for drainage. If that's not feasible, you can simply tip the container after each watering to remove any excess water that isn't absorbed by the root balls.

## GROWING AND TRANSPLANTING SEEDLINGS

Starting your plants indoors from seed isn't a necessity for getting your garden started, but it can help you get a jump start and also extend your growing season. Here are some tips for creating ideal growing conditions for your seeds, as well as some guidance for transplanting starts into your garden.

### LIGHT

No matter which way you sow your seeds or what you sow them in, they will need a good source of light to flourish. If you're starting them indoors, natural sunlight is usually not sufficient to make the seeds grow unless you have a location that gets direct sunlight for six to eight hours every day. If you don't have this kind of location, you will need to use a grow light. For new gardeners, this can sound intimidating and expensive, but it doesn't have to be! Large professional grow lights can definitely do the job easily and efficiently, but they can be expensive. When you're looking at light sources, there really are two things to consider: *lumens* and *kelvin*. Lumens represents how bright, or intense, a light is. You'll want to buy bulbs that are between 1500 and 2000 lumens. Kelvin represents the color temperature of the light, meaning how cool or warm the color of the light is and not how much heat it puts off. You'll want something that mimics the color temperature of sunlight, which is 4500 to 6500 kelvin. If the package has both of these numbers, it doesn't matter what type of bulb it is, whether it be CFL, LED, or a long shop light fluorescent tube, it should work. Note that the strength of the light from these bulbs will not be the same as professional grow lights, so the bulbs will need to be placed within 3 inches (8 cm) of the tops of the seedlings. A professional grow light can be placed 12 inches (31 cm) or more above the seedlings, depending on the strength of the light. If your seedlings are too far from the light source, even for a couple of days, you will begin to see the main stems stretching and elongating toward the light, a condition called "getting



leggy.” If this happens, your seedlings cannot be saved, and you will need to start over with a new batch. (Tomatoes are the exception to this rule. Quite often tomato seedlings can be saved by planting them deeper in another container and then building up potting mix around the stem. Tomatoes have the ability to grow extra roots along the stem that can save them from this all-too-common occurrence.)



## HEAT

Using a bottom heat source can help speed seeds to germination. You can add bottom heat by setting your seed trays on top of an appliance like a clothes dryer (just be careful when watering!), on a windowsill, above a radiator, or on a heat mat. Heat mats are invaluable for starting seeds indoors early and will supply a gentle, even source of bottom heat that will help accelerate the germination process. Heat mats are relatively inexpensive, but I suggest spending a few more dollars and getting one with a thermostat that you can control. The optimal temperature for starting seeds 75°F (25°C).



## MOISTURE

It's best to water your seeds and seedlings from the bottom to ensure the entire planting medium is watered and not just the tops. You can do this by placing the seed tray in a container of water and letting the planting medium soak up the water from below. Placing a humidity dome over your seed trays will also help keep moisture and heat in, just be sure to remove the humidity dome once the seeds have sprouted. To prevent overwatering, it's best to wait until the very top surface of the potting mix dries out before watering again. This top layer is where fungus and mold can grow, which can contribute to *damping off*.

Damping off is when your seedling stem withers at or just above the soil level and then falls over, eventually killing the seedling.





**TIP:** Placing an oscillating fan in the vicinity of your seeds will help dry out the soil surface. It can also provide the seedlings with a workout. As the seedlings rustle in the breeze, they are strengthened and will be much stronger than seedlings left to grow in stillness.

## TRANSPLANTING YOUR SEEDLINGS

The final step in growing your own plants from seed is transitioning your baby crops from the controlled, perfect indoor environment to the garden. This starts with a process called *hardening off*, which will take about a week to complete and will help your seedlings get used to their new outdoor environment. Even the strongest grow light is no match for the power of the sun's rays, so you'll need to build up tolerance in the plants. On the first day of hardening off, you should put the seedlings outdoors in the shade for a couple of hours, making sure to set them on a table or something off of the ground so they're safe from animals, slugs, and snails. Take the seedlings back indoors after this first day. On the second day, place the seedlings in the sun for an hour, move them to the shade for two or three hours, and then take them back indoors. On the third day, place the seedlings in the sun for two hours and then in the shade for three or four hours. On the fourth day, place them in the sun for three hours and in the shade for four or five hours. Continue the process until the seventh day, when they can be in full sun and will be ready for planting.





**TIP:** If it's not practical for you to follow the sun-shade scenario for hardening off, a simpler solution is checking the weather forecast to see if you will have three consecutive overcast days. On those days, you can leave your seedlings out all day, and by the end of day three they will be ready to go into the garden permanently.

## ALL ABOUT COMPOST

One of the essential elements of organic gardening is creating compost. Compost is the life of your soil, and it's incredibly easy to make your own at home.



## THE BENEFITS OF COMPOSTING

Not only is compost great for plant health, it's good for the environment as well. Composting at home helps reduce the amount of waste going into our landfills, and it helps soil retain water, especially in sandy soils. It also reduces runoff, which means you will end up watering less and experience better results. Compost is abundant in macro- and micronutrients, as well as the minerals necessary for your garden to thrive. It's full of worms and microscopic bacteria and microbes, which work together to keep plants healthy and also help them absorb the nutrients they need. When soil is full of life, you'll use



much less fertilizer, as the microbes will act as a growth catalyst, taking the nutrients from the soil and passing them on to the plants. Compost also delivers nutrients better than soil because it's tight enough that the nutrients won't leech away, but not so tight that plants can't access them.

## SOURCES OF COMPOST

Ideally, you should make as much of your own compost as possible. Homemade compost is fresh and more abundant in nutrients than the store-bought variety. And when it's made from your own garden materials, it helps foster a circle of life in your garden, while also allowing you to know exactly what ingredients went into making it. With that said, very few gardens have the capacity to fulfill *all* their compost needs; you likely would need about twice the land area of the actual garden to produce enough growing material to cover the area requiring the compost. That's an impossibility for most home gardeners, so just aim to make as much compost as you can, and then supplement your homemade supply with a high-quality compost purchased from a reliable source.

If you do need to supplement your compost supply, you can buy bagged organic compost from a garden center. Another great option, if you can get it, is organic mushroom compost; it's the planting medium used in mushroom farming, and is ideal for use in an organic garden. You can also buy bulk compost from local sources. The only issue I have with this option is that you may not know where it came from. Many cities have composting programs: picking up yard waste from homes, shredding it, composting it, and selling it or giving it away, but you don't always know what was collected with the yard waste—you're depending on thousands of homeowners who might be throwing pretty much anything into the waste. For these reasons, I choose to stay away from city and public sources. So if you can't make your own or you don't have access to organic mushroom compost, bagged organic compost from a garden center is my next choice.

As a general rule, compost is best added as a mulch on top of soil. You should add 2 to 3 inches (5 to 8 cm) to your garden once or twice a year. Depending on your soil type and growing conditions, you may need to add more.

## **MAKING YOUR OWN COMPOST**

Many new gardeners might avoid making their own compost because it seems too daunting a task and will consume time and space. This doesn't have to be the case. All you need is a good space and the right ingredients to produce this magical garden ingredient.

### **HOT AND COLD COMPOSTING**

There are two types of composting: cold (the slow but easy way) and hot (the fast but more involved way). There's no right or wrong way to do it; both types will produce excellent results. Cold composting is a more passive method and requires you to designate an area to throw compostable materials from the garden and kitchen and then simply let it all pile up. In a year or so, you'll have usable compost. (Always try to keep weed seeds, perennial weeds, and diseased plants out of a cold compost pile.) Hot composting requires a little more effort, but it will give you usable compost in a fraction of the time that cold composting requires. Hot composting requires adding a specific mix of materials to the pile to create an environment where heat is generated through the decomposition process. The pile will heat up enough to kill weed seeds and diseases, so you'll get a "cleaner" compost to add to your garden.

### **BUILDING YOUR PILE**

Whichever method you choose, I recommend constructing an enclosure to hold your pile. The good news is that it doesn't need to be fancy; it can be constructed from materials you might already have around your garden. The enclosure can be something as simple as a three-sided bay made from wood scraps. It just needs to be something that will make it tall, rather than wide. I've found the ideal size for a pile to be is around 4 cubic feet. This size allows enough room for the material to be turned, while still keeping the size of the pile manageable. You should build the pile directly onto bare soil to take advantage of the worms and other organisms that will already be present.

Another consideration is placing the pile within close proximity of both house and garden. If it's too far away from the house, you might be inclined to throw those valuable compost materials from your kitchen in the trash, rather than walking them out to your compost bin. Keeping the bin close to your garden means you won't need to make long trips to and from the pile in order to add compost to your garden.

## **WHAT TO ADD TO A HOT PILE**

To build a hot compost pile, you'll need to add the correct ratio of brown (carbon-rich) material to green (nitrogen-rich) material. If you have too much brown material, your pile will decompose painfully slowly.

Too much green material will result in a slimy mess that emits one of the worst smells you will ever experience. Compost bins should not have an unpleasant odor; great compost has a sweet, pleasant aroma that I actually love. Combining 30 parts brown material to 1 part green material is the ratio typically thrown around for perfect compost, but this can be confusing. There are very few "brown" ingredients that are 100 percent brown, and very few "green" ingredients that are 100 percent green. For example, fresh garden waste contains stems and leaves that are a combination of both brown and green since the stems are considered to be more brown than the leaves. To confuse things even further, coffee grounds are brown in color, but considered green because they impart more nitrogen than carbon. To simplify things, use the following table to sort your ingredients.



*"Green" ingredients will impart more nitrogen to the pile.*





*"Brown" ingredients will impart more carbon to the pile.*

<b>GREEN MATERIALS</b> (Nitrogen producing)	<b>BROWN MATERIALS</b> (Carbon producing)
Coffee grounds	Dead leaves
Tea bags	Twigs, chopped tree branches, bark
Grass clippings	Wood ash (sprinkled in small amounts)
Fruit and vegetable scraps	Pine needles
Trimmings from perennial plants	Sawdust
Trimmings from annual plants	Cornstalks
Eggshells	Cotton fabric
Seaweed	Straw
Annual weeds that haven't set seed	Uncoated cardboard (without waxy, slick coatings; staples; or tape)
Animal manures (cow, horse, sheep, chicken, rabbit [no manure from meat-eating animals])	Uncoated paper products (newspaper, writing or print paper, paper plates, napkins, coffee filters)

## STARTING A HOT PILE

Once you have your ingredients sorted, begin adding the ingredients in 6-inch-thick (15 cm) alternating layers of green and brown materials to achieve a 50:50 ratio. (Because there is some green in brown and some brown in green, you're going to be close to a 30:1 ratio.) Fill the bin until it can hold no more. Over the next few weeks, the pile will heat up to 135°F–160°F (57°C–71°C). In about 30 days, the pile should be ready to turn and should then be turned every 30 days thereafter to keep the compost mixed and to increase oxygen in the pile to help speed decomposition. From start to finish, the process could take anywhere from six weeks to six months, depending on your climate, moisture levels, and pile ingredients. If you have the space, you could build three or four bins and start your first pile in the first bin. Thirty days after filling the first bin, turn it all into the second bin and fill the emptied first bin with new materials. In another 30 days, turn the contents of the second bin into the third bin, and the contents of the first bin into the second, and once again fill the first bin with new material. In another 30 days, the third bin may be ready for use. If not, turn it into the fourth bin for finishing.



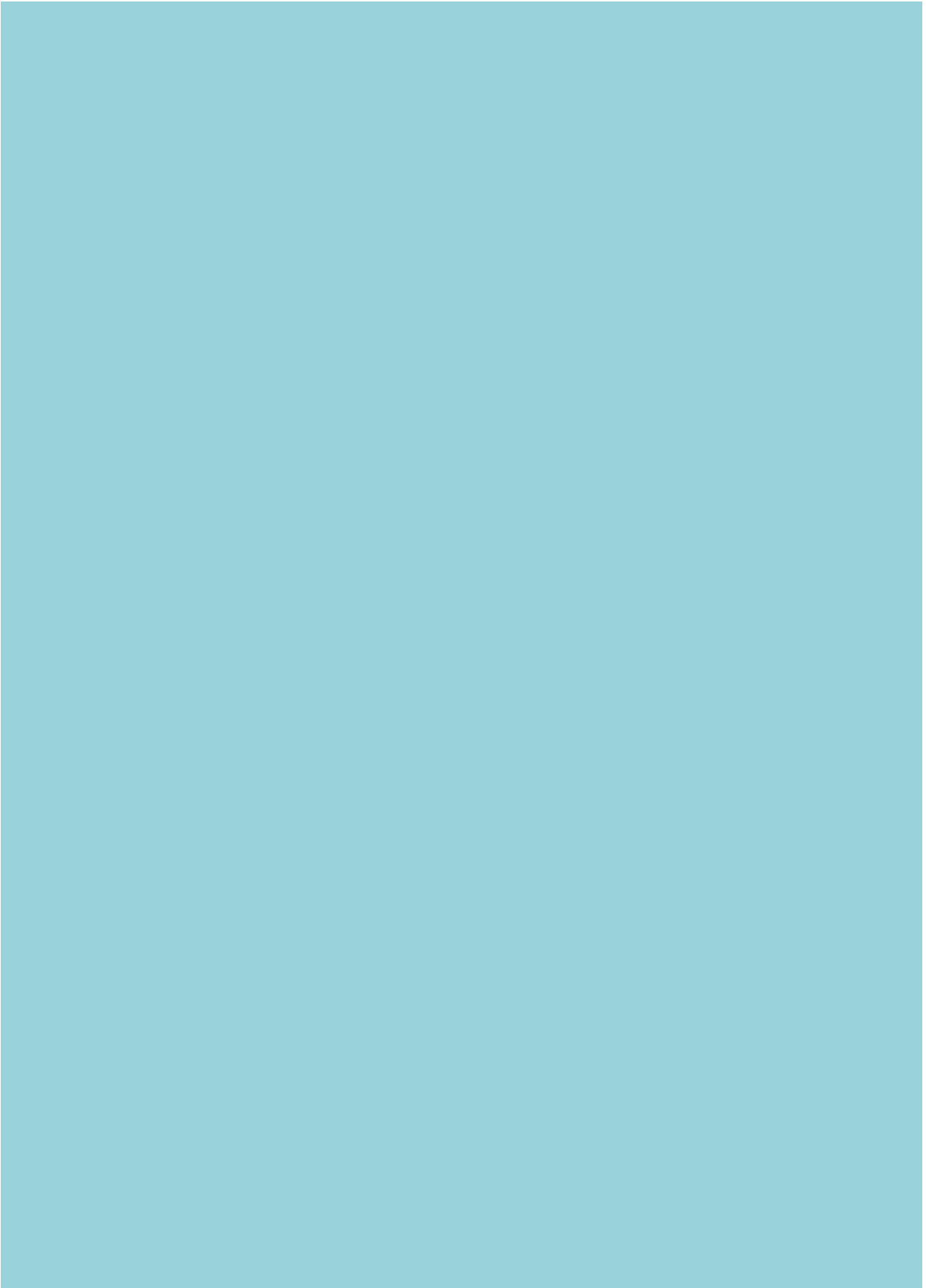
## **Other Helpful Composting Tips**

- To accelerate the decomposition process, add some finished compost to each new batch.
- Keep the moisture level in your pile about like a wrung-out sponge. If needed, add moisture from a garden hose from time to time.
- If you live in a wet climate, you may need to add a roof, or cover the pile with a plastic tarp, to keep the pile from getting too wet. If you live in a dry climate, a tarp can help keep moisture in the pile.
- To speed the decomposition process, make sure the materials you are adding are small in size. A chipper or shredder is great if you have one, but if you don't, simply toss the materials on the ground and mow over them with a lawn mower. This will pulverize the materials and increase the surface area that bugs and microbes can access to break it all down.

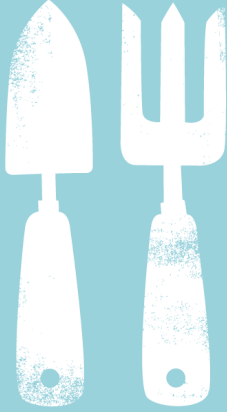
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## CHAPTER 3

# COMPANION GARDEN PLANS

There is no perfect formula for creating a companion garden, but I've put together these basic garden plans to help you get started with the planning process. You can create circle-shaped beds or square-shaped beds, and you can expand or even combine these plans in any manner you wish—it's the plant spacing and companion relationships that are important to pay attention to. If you do combine bed designs, just be sure to include adequately spaced paths so you can reach the plants without having to step into the growing areas too much. The plans in this chapter are designed for beds that are approximately 4 to 5 feet (1.25 to 1.5 m) by 10 to 12 feet (3 to 3.5 m). These are the sizes I like to use because they are narrow enough that I can still reach into the growing areas without having to step into the beds but not so long that I have to walk a long way around them.

**COOL SEASON ROOTS AND LETTUCE**

**COOL SEASON POTATOES AND LEGUMES**

**COOL SEASON BRASSICAS**

**WARM SEASON CUCURBITS**

**WARM SEASON NIGHTSHADES**

## COOL SEASON ROOTS AND LETTUCE

This bed plan is made up primarily of root crops: carrots, beets, onions, and garlic, all of which are grown, or at least planted, in the cool season. One of the biggest enemies of carrots is the carrot fly maggot, and the carrot fly finds carrots through their scent, so ringing a carrot planting with strong-smelling chives will help mask the odor the carrots produce and thus thwart a carrot fly attack. You can grow up to 16 carrots per square foot, and 6 to 8 beets per square foot. Lettuces are frequently damaged by aphids and flea beetles, so I plant them around alliums—like chives, onions, and garlic—and sweet alyssum. All of these companions will help keep both pests at bay. You can plant up to 4 onions and 4 lettuces per square foot. A common pest for garlic is thrips. Planting a carpet of sweet alyssum under the garlic will attract hoverflies, whose larvae will kill and eat both aphids and thrips. You can plant 4 garlic cloves per square foot.

### CROPS:



**Beets**



**Carrots**



**Garlic**



**Lettuce**



**Onions**

### COMPANIONS:



**Chives**



**Sweet alyssum**





## COOL SEASON POTATOES AND LEGUMES

This bed is comprised mainly of peas, potatoes, and bush beans, all of which can be planted in the spring. Rarely do I plant vegetables in rows, but these three crops lend themselves to row planting because of the way they are grown. Peas need a trellis to support them, and even though you can use a teepee and plant in groups, I find they are easier to manage and harvest when they're grown on a long, flat trellis.

Potatoes need to be continually covered during the growing season, and this is made much easier when they're planted rows. Potatoes should be spaced 12 inches (31 cm) apart, peas 2 inches (5 cm) apart, and bush beans 6 to 8 inches (15 to 20 cm) apart. You'll want to plant the companion plants between the crop rows. (Most of the plants in this garden plan are tall and skinny, so the companion plants will not overcrowd or shade your main crops.) Hairy vetch planted with potatoes or as a cover crop before potatoes can help alleviate blight.

Potatoes are nitrogen hungry and grow well with legumes like peas and beans, both of which take nitrogen from the air and hold it in nodules in their root systems. Potatoes help drive away Mexican bean beetles, which can wreak havoc on beans. In return, beans ward off attacks from a huge potato pest: the Colorado potato beetle. Both of these beetles can be further managed by attracting minute pirate bugs to this bed with a planting of marigolds. Also planted in this bed are dill and cosmos, which will attract a wide variety of good bugs like ladybugs, lacewings, damsel bugs, and hoverflies, all of which will help control aphids, red spider mites, and whiteflies.

### CROPS:



**Bush beans**



**Peas**



Potatoes

## COMPANIONS:



Cosmos



Dill



Hairy vetch



Marigolds



## COOL SEASON BRASSICAS

This is a cool season bed which can be planted in the fall in mild winter climates and in early spring in cold winter climates. The main crops here are three different types of brassicas: broccoli, cauliflower, and cabbage. Being part of the same family means they have similar growing requirements and share the same pests. Most brassicas need spacing of around 18 inches (46 cm) between them. This bed could be in full sun or partial shade, with at least four to six hours of sun per day. Brassicas take months to mature and can take up a lot of space, so I always fill in the space around them with leaf lettuce. Leaf lettuce is a great space saver, and spacing isn't all that important if you use the cut-and-come-again method for the lettuce, basically harvesting the leaves as they grow or cutting the entire plant off 1 inch (3 cm) above the soil and waiting for it to regrow before you harvest again. Lettuces have minimal root systems to compete with the brassicas whose roots go deep; and lettuces are quick growing and don't mind the extra shade they'll get from the brassicas. You could have several crops of lettuce growing during the brassica season. For pest control in this bed, I include plants that are known to help manage the two most common of the brassica pests: aphids and cabbage worms. Planting sweet alyssum and dill will attract hoverflies, lacewings, ladybugs, and parasitic wasps, which all will help control the aphids and cabbage worms. Nasturtiums and calendula are trap crops that will attract any aphids the beneficial insects miss and also give the pests a more enticing meal than the brassicas and lettuce.

### CROPS:



Broccoli



Cabbage



Cauliflower



Leaf lettuce

## COMPANIONS:



**Calendula**



**Dill**



**Nasturtium**



**Sweet alyssum**





## WARM SEASON CUCURBITS

The main crops in this warm season bed are members of the cucurbit family: squash, melons, and cucumbers. The squashes in this plan could include summer squashes like zucchini and yellow squash or they could include winter squashes like acorn or butternut. Planting them in the same bed will allow you to deal with the pests they all share, and they all have similar growing requirements including full sun and rich, fertile soil with lots of moisture. Summer squashes should be spaced about 18 inches (46 cm) apart. Winter squashes and cucumbers should be grown on trellises and spaced 12 inches (31 cm) apart, or grown on teepees whose legs are 12 to 15 inches (31 to 38 cm) apart. (Plant one to two plants per leg.) Common pests of the cucurbit family are cucumber beetles, aphids, squash bugs, and the squash vine borer. All four of these pests start as larvae or eggs, both of which can be managed before they reach adulthood by tachinid flies and parasitic wasps. To attract these beneficial insects to this squash bed, I have included dill, as well as cosmos (or zinnias). I have planted a ring of radishes around the cucumbers because they are a trap crop for aphids. Allowing some of the radishes to flower will attract lacewings, which will help deal with the trapped population of aphids. Planting a ring of nasturtiums around the squash will help repel squash bugs. All of the flowering plants in this bed will attract pollinators for the squash and cucumbers. Another creative way to keep squash bugs and squash vine borers off of your main crops is to plant a trap crop of blue Hubbard squash 5 to 10 feet (1.5 to 3 m) away from the bed. Studies have shown that squash vine borers and squash bugs prefer this heirloom variety over all others. Blue Hubbard squash also seems to be more resilient than other squash varieties when under attack by squash bugs.

### CROPS:



Cucumbers



**Melons**



**Radishes**



**Squash**

## COMPANIONS:



**Cosmos (or zinnias)**



**Dill**



**Nasturtiums**



## WARM SEASON NIGHTSHADES

This is a warm season planting made up of crops from the nightshade family: tomatoes, peppers, and eggplant. Tomatoes take up the most space; I have them growing in a row, planted 12 to 15 inches (31 to 38 cm) apart because of the way I trellis them. (See the tomato section in [Vegetable Reference](#) for instructions on trellising tomatoes.) Basil is my favorite companion for tomatoes, not only because together tomatoes and basil smell so good in the summer garden, but also because the strong scent of basil will confuse the hawk moth, which is the moth that lays eggs that become the dreaded tomato hornworm. The hawk moth searches for tomato plants through scent, and the strong scent of basil will throw them off. (I have had zero tomato hornworms on my plants since I started companion planting with basil.) Plant your basil 8 to 10 inches (20 to 25 cm) apart and all along the row of tomatoes. Plan to let some of the basil you will not be harvesting go to flower; it's a great attractor of beneficial insects and pollinators. Spearmint does the same thing and also attracts minute pirate bugs which can help fight common nightshade pests like aphids, caterpillars, spider mites, and whiteflies. (Always grow your mint in pots as it is very invasive.) Near the eggplant and peppers, I have plantings of sweet alyssum and radishes. The radish will serve as a trap crop for flea beetles, and the sweet alyssum will attract braconid wasps which are natural predators of flea beetles. Braconid wasps are also predators of many species of larvae that fall under the "leaf miner" heading which can be highly destructive to peppers and eggplant, but are well controlled by parasitic wasps such as the braconid. Parasitic wasps also can control tomato hornworm, should you happen to get some in spite of the basil and spearmint.

### CROPS:





## COMPANIONS:



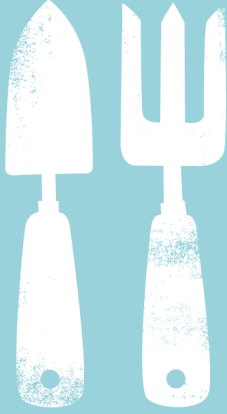
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## CHAPTER 4

# SOIL—CREATING THE FOUNDATION

**UNDERSTANDING SOIL STRUCTURE AND MAKEUP**

**USING THE NO-DIG METHOD**

**RELIEVING HARD OR COMPACTED SOIL**

**USING COVER CROPS TO IMPROVE GARDEN SOIL**

**HOW TO GROW COVER CROPS**

**USING ORGANIC FERTILIZERS**

## UNDERSTANDING SOIL STRUCTURE AND MAKEUP

Determining the type of soil you have in your garden is one of the most important first steps. It can tell you what future issues might arise and how to fix them, and it can also give you a guide for how to water, fertilize, and amend the soil.



## SOIL TYPES

There are four common types of soil, and each type has unique attributes and associated problems. Here are some tips for preparing each type for planting.

### **Sandy Soil**

Sandy soil feels gritty to the touch, and won't hold together if you squeeze it, even when it's damp—water and nutrients can drain right through it. And it's “hungry,” meaning it will eat up humus.

Fixing sandy soil isn't easy and takes some work. The first step is to add as much organic matter to the soil as possible. Work in at least a 4-inch to 6-inch (10 to 15 cm) layer of well-rotted manure or compost before planting, and then apply a 2-inch to 3-inch (5 to 8 cm) layer of mulch after planting to protect plants from soilborne diseases and also help smother weeds. (For sandy soil, mulch is a must-add for water retention!) You can also put down a layer of uncoated cardboard or uncoated newspaper before planting to help hold even more moisture in the soil.



### **Silt**

Silt soil is similar to sandy soil, but the particles are rounder, more weathered, and smaller than sand particles. If you rub silt soil between your fingers when it's moist, it feels smooth and slippery. It holds more water than sand, but because of the smaller particle size, it tends to compact when it's wet, so you don't want to walk in silty beds unless they are dry. The benefit of silt over sandy soil is its water retention



capability, and it holds onto humus and nutrients much longer than sandy soil. However, it still needs to have a good amount of organic matter added. To amend silt, work in a 3-inch (8 cm) layer of well-rotted manure or compost, followed by a 2-inch to 3-inch (5 to 8 cm) layer of mulch.



## **Clay**

Clay soil is very firm and feels slippery and sticky when wet. In fact, if you step in clay when it is wet, it might just pull your shoe right off. If you squeeze clay soil that is damp, it will stay in a ball and you can even see the wrinkles of your hand and sometimes even your fingerprints. Clay soil contains the smallest particles of any soil—less than .002 mm in size, which is really small! And because of this small size, the particles will stick together. (This is why you can make pottery with it.) If you add enough organic matter, clay soil can be one of the most productive soils to grow in. Clay particles are negatively charged, so they attract

and hold on to positively charged minerals like potassium, calcium, and magnesium. Clay soil also holds onto moisture, which is good when water is scarce, but it can become waterlogged very easily. Adding lots of organic matter can help remedy that problem. If you have really tough clay, you can add gypsum (about a handful per square foot) along with the compost. One note of caution about clay: never ever work it when it's really wet. It will compact very easily and create a hard, almost impenetrable crust that will be impossible to plant in.

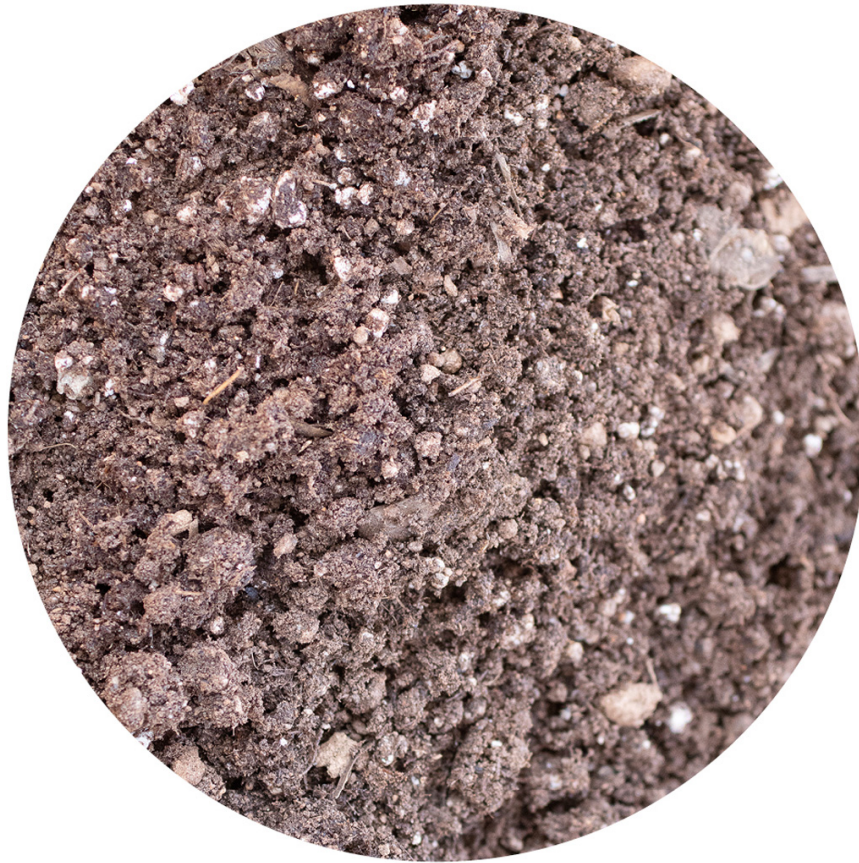


### **Loam**

The best type of soil is loam, which is a mixture of 40 percent sand, 40 percent silt, and 20 percent clay. Loam can be broken down into light loam and heavy loam. Light loam has more sand, while heavy loam has more clay, but both types are very fertile. Loam holds water and nutrients well, but at the same time, is well draining. If it's heavy loam, you can still experience compaction issues when it's wet. Loam soil still will benefit from annual additions of organic matter applied as mulch on



top of the soil and also applied across the growing season. (The worms will work it into the soil.)



## HOW TO TEST YOUR GARDEN SOIL

If you're not able to determine what kind of soil you have, you can perform a test to identify your garden's soil type. You'll need a 1-quart (1 L) Mason jar, water, and a few soil samples from your garden.

1. Collect the soil samples. (You can mix several soil samples from different areas of your garden in a bucket and perform a test to get an average, or you can test several individual areas.)
2. Fill the jar half full with the soil sample.
3. Fill the jar almost full with water, leaving enough of a gap at the top that you can shake it to mix the soil and water.

4. Secure the lid tightly and shake the jar vigorously for a minute or two or until the soil and water are well combined.
5. Let the jar sit undisturbed for 24 hours.

After 24 hours, you will begin to see the layers separating into sand, silt, and clay. The sand is the heaviest and will be the bottom layer in the jar, followed by the silt in the middle, and the clay at the top. Ideally, you want to see a ratio of 20 percent clay, 40 percent silt, and 40 percent sand, which will give you perfect loam! If you have anything other than that, you should amend the soil to correct the balance. Another indicator of the quality of soil is color. A pale color means you are lacking organic material and need to add more, while a darker soil is healthier and contains more beneficial life.



### **Humus: The Life of Your Soil**

Humus—not to be confused with that delicious Greek dip, hummus—is that rich, black, crumbly, sweet-smelling gold that is the end result of composting! It's the rich, decomposed organic matter that holds moisture, nutrients, and microorganisms, and it allow plants to grow. None of the four main soil types will be able to support a thriving garden without it.



## **USING THE NO-DIG METHOD**

No-dig is exactly what it says: no digging. In organic commercial farming and even some nonorganic commercial farming, the no-till method has become a popular way for farmers to maintain soil health, cut down on pollution, reduce the cost of running large farm equipment, and reduce soil compaction and erosion. The no-dig method is pretty much the smaller, home-scale version of the no-till method for us home gardeners.

### **WHAT ARE THE BENEFITS OF THE NO-DIG METHOD?**

When starting a traditional garden, typically you first dig out any grass or weeds, till up the soil, add amendments, and rake the soil flat. That's a lot of work, and it's also counterproductive. With the no-dig method, you don't amend and turn the soil every year or dig out plants that have produced and are finished. Instead, you will add a thick layer of compost as mulch and then plant directly into it, adding several more inches of compost on top each year. The worms and the other good guys will then work the compost down into the soil. When the plants are done producing, instead of digging them up you'll cut them off at ground level and let the soil reclaim them. What's left will provide food for the beneficial critters in the soil, who will leave behind air pockets to aerate the soil.

The no-dig method doesn't disturb the established beneficial microbial, fungal, and mycorrhizal associations within the soil; the less the soil is disturbed, the easier it is for all the life in there to carry on daily business. Another benefit of no-dig is that there is less weeding. When you turn over the soil, you can expose weed seeds that were previously buried too deep for germination. By digging up the soil, you can literally help hundreds of weeds spring to life that you eventually will have to pull, but no-dig prevents this. You'll also have the added benefit of planting in pure compost. Compost holds onto nutrients and

moisture better than soil, so you will be watering and fertilizing less. Using the no-dig method is also easier on your back. It's much less work, and you will have a much more fertile and productive garden. Harvesting is a bit different with the no-dig method as well. Instead of removing the plants, you'll cut the plants off just beneath the soil surface. All those roots are still home to mycorrhizal fungi and are food to earthworms and other beneficial soil organisms. And as soon as the roots decompose or are eaten, life-giving oxygen pockets are created in the soil.

## **HOW TO BUILD GARDEN BEDS USING THE NO-DIG METHOD**

Follow these simple steps to start your garden bed using the no-dig method.



**Step 1:** Choose your growing space. If the space contains lawn or weeds, lay down one or two layers of uncoated cardboard that has had the staples and tape removed. Overlap the cardboard at the seams and openings so no light can creep through. The cardboard will help keep out any light and will slowly starve the vegetation beneath it.





**Step 2:** Thoroughly soak the cardboard with water.



**Step 3:** Add 4 to 6 inches (10 to 15 cm) of organic compost on top of the cardboard and then rake it flat. If desired, add untreated 2 x 6 inch (5 x 15 cm) wood sides.





**Step 4:** To create paths between the beds, place wood chips on top of the cardboard in place of compost.



**Step 5:** Sow your seeds or plant your transplants directly into the compost.

At the start of each new growing season you will need to add another 2 to 3 inches (5 to 8 cm) of compost to the planting beds. Some of the compost will also be depleted during the growing season, so you'll need to occasionally add more around the plants.



## Mycorrhiza and Its Role in the Garden

Mycorrhizae (Greek for *fungus root*) are fungi that colonize a plant's root systems both inside and outside of the actual root cells. These fungi play an important role in plant and soil health.



The workings of this relationship between plant and fungus are very intricate and involved, but simply put, the plant makes carbohydrates through photosynthesis and passes some of the carbohydrates on to the mycorrhizal fungi. In return, the fungi help increase the plant's water and nutrient absorption capabilities. Mycorrhizae send out their own filaments, which are up to 200 times farther reaching than the roots they have colonized. This allows them to reach far and wide to gather water and nutrients and then transmit these vital ingredients back to the plant. The good news is that mycorrhizal fungi are most likely already in your garden soil, so unless your soil has been severely damaged through contamination, you won't need to add any.

Mycorrhizae thrive in soils that are rich in organic matter, so the addition of mulch and compost will feed and foster the development of these fungal communities in the root systems of your plants. Adding two to three layers of compost once or twice a year (preferably organic and homegrown compost, if possible) is ideal. Feeding your plants and soil with organic fertilizers, such as fish, kelp, and blood and bone meals, as well as humates, is also a great way of doing this.

To protect the thousands of miles of microscopic mycorrhizal hyphae or filaments woven through your garden, try not to till, turn, or even dig into your soil more than is absolutely necessary. Digging into your soil severs the lines of communication between plants that travel along these networks.

## **RELIEVING HARD OR COMPACTED SOIL**

A lot of gardeners complain about how compacted their garden soil is, but quite often the soil may not be compacted and may just be hard soil that needs some attention. Either way, there are solutions for both compacted and hard soil situations.



## PLANTING IN HARD OR COMPACTED SOIL

Compacted soil and hard soil are not the same things. Fortunately, truly compacted soil is pretty rare. Truly compacted soil has very little life, both underneath the soil surface and on top of it. Hard soil, be it clay or otherwise, will still have plant life growing in it, which means the soil is fertile and not severely compacted. Also, if the area is wet, truly compacted soil will have water pooling on top of it for an hour or more, while water will drain into hard soil more quickly. Truly compacted soil often can occur in new housing tracts where heavy machinery has been used, or with heavy clay soils that have been traversed while wet. If your soil is really compacted, you might need to dig or till the soil, add 4 to 6 inches (10 to 15 cm) of an organic material like compost and then rake the surface flat. Once you've taken these steps, you should be able to plant your vegetables in it. If you just have firm or hard soil and you don't want to go to the trouble of digging or tilling the dirt, you can simply add 6 inches (15 cm) of compost directly on top of the soil and then plant directly in it.

## USING BIODRILLING COVER CROPS

In both situations, you will still have firm, hard soil underneath the surface. In order to really loosen the ground at the root level, you'll need to dig deep, and that's where companion planting can come to the rescue with biodrilling cover crops. Biodrilling cover crops are plants with thick, large roots that work slowly over their season to “dig” down and break up heavy soils. These crops can reach depths that aren't possible for the average gardener. Forage radish—also known as *tillage radish*—works extremely well for this job. Its long roots can mine nutrients that are too deep in the soil for most plants to reach. When the radishes die and decompose, some of these nutrients are left closer to the surface and within reach of most other crops. The thick upper portion of the radish can penetrate the soil by almost 2 feet (0.5 m), and the rest of its taproot can travel several feet farther. These plants are the heavy-duty workhorses of biodrilling. Usually these plants are used in preparation for planting and not interplanted with other crops.



A great time for planting forage radishes is in late summer or early fall when the root systems can grow to maturity, and then be killed off by winter cold. If you don't have freezing winters, let forage radish go to flower, and then cut it off at soil level. As the root system dies and dries up, large and small channels, or air pockets, will be left to invite oxygen and water into the soil. While living, the roots host colonies of mycorrhizae that will bring new life to the soil. As the roots decay, that organic matter will be a source of food for good bacteria and earthworms, which will continue to work the soil further. The voids left by all of the radish roots will create a sort of roadmap for the roots of new crops to use to find their own space, water, and nutrients.

If your soil is less dense but still needs some working, you can take advantage of a smaller, more edible crop that can do a similar job to the forage radishes. Any daikon-type radish will fit the bill. You can plant smaller daikons with your other crops in spring. Fava (broad) beans also have deep tap roots that can make their way through hard soil and pull nutrients up from deep in the soil. They are also a legume, which means they fix their own nitrogen in the soil, which other plants can eventually use.

Winter rye is a great cover crop for cold temperatures that has a deep, strong root system. Planted in fall, it will remain all winter and continue its growth into spring, when you can then cut it down and leave right on the surface of the soil as a green mulch.

## **USING COVER CROPS TO IMPROVE GARDEN SOIL**

Cover crops are nonharvestable plants that can be used either between growing seasons when nothing else is growing in beds or planted in and among harvestable crops as a living mulch during the growing season. Cover crops can serve many purposes in gardening, including improving the quality of your soil.

### **THE BENEFITS OF COVER CROPS**

When garden beds go unused, even for a season, the soil structure and soil life can break down, and the soil can even erode. Cover crop foliage helps protect the soil surface from heavy rain because the roots will help hold the soil together. Continuous use of cover crops in your garden will help improve soil structure by increasing organic matter, which improves the soil's ability to hold moisture and also provides nutrients for plants. Cover crops can even help alleviate soil compaction by working their deep roots down into layers that are compacted, leaving behind channels that, once the roots decay, will fill with water. Worms and other soil life can inhabit the channels to help finish the job of loosening hardened soil.



## MY FAVORITE COVER CROPS

My favorites are in the legume family. They can absorb nitrogen from the atmosphere and, through their roots, transfer it directly into the soil they're growing in. This means if you grow cover crops like peas or crimson clover (yep, it's a legume), the crops will form nodules in their root systems that are full of nitrogen. When the plants are cut down in their prime, they leave those nitrogen stores for the next plants that inhabit the area. This process is called *nitrogen fixation*. Here are some of my favorite nitrogen-fixing cover crops.





*Broadcast sowing oat seeds will result in a perfect cover crop.*

### **Crimson Clover**

My absolute favorite cover crop is crimson clover. It's a cool or warm season crop; it maintains a nice shape and looks almost like an ornamental, especially as it blooms. The blooms attract pollinators and other beneficial insects to your garden, and the plants themselves serve as habitats for these insects. Because it's in the legume family, it will fix nitrogen for your next crop to enjoy. You can sow crimson clover in fall, let it grow all winter, and then cut it down in spring—about a month before planting nitrogen lovers like squash, corn, leafy greens, and brassicas. It is cold hardy down to 0°F (-18°C). In northern gardens, where it gets colder, you can let the cold kill it and then leave it to decay

on the ground during the winter. Now, I know what you might be thinking: Why would you want to plant a weed in your vegetable garden? Well, this is where timing the cutting factors in. Don't let those beautiful crimson flowers seduce you into letting them go just a little longer. As soon as the flowers start to bloom, you'll need to cut the plants down to the ground.

### **Winter Rye**

Winter rye is a cold-tolerant cover crop that can live through temperatures as low as -30°F (-34°C). You'll want to sow winter rye in fall. It will slow down through winter and begin growing again in spring. As with crimson clover, it needs to be cut down as soon as it starts to flower to keep it from setting seed and giving your garden a permanent lawn. Winter rye is allelopathic, which means if you leave its residue to decompose on top of the soil, it will suppress the seed germination of other plants. This is great for weed control (which we will discuss further in [Weed Management](#)), but not so great if you will be sowing small vegetable seeds in the same area within a month. Within that month, the rye should be completely brown, at which point there is less of a chance of allelopathy to affect the seeds. Seedlings and transplants, however, will not be affected, even when the rye residue is still green.

### **Buckwheat**

Buckwheat is a warm season cover crop that grows quickly. It can be cut down and planted into within 40 days, meaning you can plant summer crops among the residue in just five to six weeks, once all danger of frost is past. The abundant flowers will attract pollinators and beneficials like hoverflies, but the plants do need to be cut down soon after they have reached about 25 percent bloom, which will be about a week into flowering. At that point, buckwheat will not regrow from the roots nor has it had time to fully develop its seeds. Some research has indicated that buckwheat could pull phosphorus up from deeper in the soil and once the plants are cut down, returns it to the top layer where the next crops can access it.





*Buckwheat seeds before planting*

## **COVER CROPS TO AVOID**

Some cover crops, like soybeans and wheat, are best left to larger farms. If you have a small garden or raised beds, you will want to avoid planting perennial cover crops because they can become invasive and take over your beds. Some cover crops can also be invasive if you don't till them under deeply enough. (Because I practice no-dig, these won't work in my garden.)

## HOW TO GROW COVER CROPS

Now that you know which cover crops to plant, you'll need to know how to plant them and use them in your garden.



## WHEN TO PLANT COVER CROPS

Cover crops are typically sown in spring or fall. For cool season cover crops, the time to plant is in fall, about four to six weeks before cold weather arrives to kill them off or at least slow or stop their growth. Sow your chosen cover crop according to package directions. If your late harvestable crops are done producing, cut them down or pull them out, and then rake the bed over. You can add a layer of compost if needed, and then sow your cover crop seed across the entire bed. If you still have some crops producing, leave those and sow your cover crops around them.

## WHEN TO CUT COVER CROPS



Let cover crops grow through their life cycle until they flower. Once they flower, cut them down to the soil level. The timing of this cutting is important for two reasons: first, the plant will be at its most beneficial to the soil just as soon as it begins to flower—there will never be a better time to cut it down and let its nutrients return to the soil; second, you don't want your cover crops to set and drop seed. Not only will the plants diminish the nutrients in the soil, but the seeds will germinate, and you will then have the beginnings of a difficult mess to control.

Some cover crops will die during the winter, and others will slow down and continue their growth into spring when the weather warms up. If your crop is not killed by cold weather, you'll need to cut down the plants to soil level just as they begin to flower in the spring. If you cut them too early, they may regrow. If you are tilling your garden, you can simply turn the plants under the soil. Turning the plants under the soil has the added benefit of getting the nutrients deeper into the soil; however, it can also break up the soil network of fungus that is so crucial to good growth.

If you choose not to till, you can simply leave the cut plant material on the soil surface. You'll want to make sure the plant material is cut and pulverized into smaller pieces. A lawn mower is the ideal way to cut the plants back and chop them into smaller pieces. A string trimmer or pruning shears can also be used to cut the plants down, but you'll need to do some extra work to get them down to the right size. If you're using either of these tools, cut the plants at several levels to leave as few long branches intact as possible.

## **PREPARING THE AREA FOR PLANTING**

After cutting down the cover crops, you will need to wait three to four weeks before planting in the area to allow time for the plant residue to be incorporated into the soil. During this time of incorporation, new plants can have a difficult time getting established, so this is an important step that should not be skipped. After cover crops are cut down, the roots will continue to be a home for mycorrhizal fungi and

will serve as a food source for worms and other beneficial insects that inhabit the soil. As those root systems decay or are eaten, they will provide more organic matter for the soil, improving its structure and composition. The vegetative growth above the soil surface that was cut down, also called *residue*, can be used in three ways:

- If your cover crops are the only plants in that area, and if you are not following a no-dig practice, you can work this residue into the soil and let it decompose for three to four weeks before planting your next harvestable crops.
- If the cover crops are planted in and among existing plants or you are following a no-dig practice, you can cut down the cover crops and leave the residue right on the surface of the ground to decompose.
- If there is more residue than the area can handle, add it to your compost bin. (If the site of this decomposing ruffraff is unsightly to you, as it is me, simply cover it with a shallow layer of mulch like straw or wood chips. The residue will break down underneath and impart all of those nutrients to the soil within three to four weeks.)



## USING ORGANIC FERTILIZERS

Fertilizer is an important component of growing any garden, and while companion plants can provide many of the needed nutrients in garden soil, every garden can use the boost that safe organic fertilizer options can provide.



## WHAT IS FERTILIZER?

Fertilizer is any material—organic or chemical—that provides essential nutrients for plant growth. You might be wondering why you need to use fertilizers since nature doesn't fertilize and plants still produce, but in nature, a wild tomato isn't producing fruit for consumption: it's producing fruit to make seeds to reproduce the plant. This means it can



make seeds with very inferior fruit that a lot of us would turn our noses up at, but the tomato doesn't care; it's made seeds and guaranteed the next generation of tomato, so its work is done. What we want, however, are tomatoes that taste and look great, which means we need to give those plants a boost. So if you want to guarantee a huge harvest of plump, juicy tomatoes in your garden, you'll need to fertilize with essential nutrients.

Since most soils do not contain the sufficient amount of nutrients needed by plants to thrive, you'll need to use fertilizer throughout the growing season. Even if you add generous amounts of rich compost during the growing season, the essential nutrient percentages of compost and even most manures are very low, so the plants are going to use those nutrients in their growth and production. This means you'll need to supplement soil nutrients with fertilizer to get your crops to produce well.

## ORGANIC VERSUS SYNTHETIC FERTILIZERS

The three main essential nutrients of any fertilizer are nitrogen (N), phosphorus (P), and potassium (K). Every fertilizer bag, box, or bottle has three numbers on it, and these numbers represent the percentage by weight of each these nutrients. The first number is nitrogen (N), the second number is phosphorus (P), and the third number is potassium (K).

To help remember what all this means, remember the saying "shoots, roots, and fruits." *Shoots* refers to nitrogen, which promotes vegetative growth or leaves; *roots* refers to phosphorus, which promotes root growth; and *fruits* refers to potassium, which helps build the quality and size of fruits, vegetables, and flowers.

Organic fertilizers are derived from materials that occur in nature, be it plant, animal, or mineral sources; whereas nonorganic or synthetic fertilizers are manufactured in chemical plants. Synthetic fertilizers have high NPK percentages, so a synthetic fertilizer like MiracleGro has

percentages of 24-8-16. These are all very high numbers, especially in nitrogen which means you'll see a lot of leafy green growth. This may sound great, but synthetics are also immediately absorbable, and plants can't always support such a quick, heavy shot of nitrogen, so the plants can get spindly and floppy. These high-nitrogen options can also easily "burn" your plants if you apply too much.

In contrast, organic fertilizers will have numbers more like 2-4-2, which means the fertilizer contains a slower, more sustainable amount of the three nutrients. The additional benefit of organics is that in addition to the three essential nutrients, they provide an abundance of thousands of other nutrients, minerals, enzymes, and microorganisms that are essential for plants to thrive. Synthetic fertilizers not only don't give you these added components, but also can kill the beneficial enzymes and microorganisms that are already in the soil. So it's kind of like the tortoise and the hare: slow and steady wins the race.

## **APPLYING ORGANIC FERTILIZERS**

Organic fertilizers come in two forms: granular and liquid. Which option you choose will depend on when and how you're feeding your vegetables.

### **Granular Fertilizers**

Granular options include blood meal, bone meal, kelp meal, chicken manure pellets, and pulverized crab and lobster shells. Granular fertilizers are great for adding at planting time. I always add granular fertilizer to the planting holes before planting my seedlings, or I mix it into the top few inches of soil before I sow seeds directly into the garden soil. Granular fertilizers release their nutrients slowly over the course of a few months or throughout the growing season. If you want to make them more bioavailable (simply meaning the ratio of the compounds that are available at a given time) at planting time, add them to the soil in fall for spring planting. Of course, this won't apply if you have mild winters and are able to garden year-round. There are a lot of soils that do not allow phosphorus to move through the soil freely, so

with this nutrient in particular, it's a good idea to work some granular fertilizer into the hole beneath what you are planting so the roots can take advantage of it.

### **Liquid Fertilizers**

Liquid fertilizers include fish emulsion, hydrolyzed fish, liquid seaweed, and compost and manure teas. These fertilizers are generally added every two weeks throughout the growing season and will give plants immediate access to nutrients, filling in the gaps left by slow-release options. Liquids can be applied to the soil or directly to leaves through foliar feeding with a sprayer. When you foliar feed, the plant can directly absorb far more nutrients and utilize them more quickly than with soil feeding through irrigation.

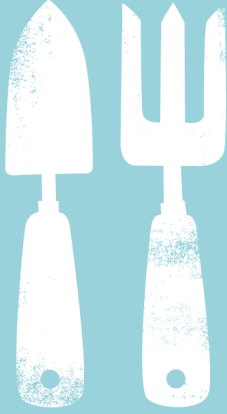
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## CHAPTER 5

### **WATERING—NURTURING THE GROWING ENVIRONMENT**

**DETERMINING WATER NEEDS**

**METHODS FOR EFFECTIVE WATERING**

**USING TRADITIONAL MULCH TO CONSERVE WATER**

## DETERMINING WATER NEEDS

Far and away the question I get asked most is this: How much should I water my plants? Watering is an important part of maintaining a healthy garden, but it's a relatively easy thing to manage just as long as you know how to determine if your plants are thirsty.

## DETERMINING WATER NEEDS

There is a simple way to check the moisture level of your soil; it's called the "finger test," and it is the most reliable way to tell if your plants need water. The finger test will work for just about every plant and will work for in-ground, raised-bed, and container gardens. All you do is simply stick your finger into the soil to a depth of about 2 inches (5 cm). If you feel moisture, you don't need to water; if it still feels dry at that depth, you should water your plants. It really is that simple. You should never use the soil surface as a gauge to determine if your plants need water. Unless plants have just been watered, it's totally normal for well-watered plants to have a dry soil surface but still have sufficient soil moisture just underneath the surface. Except for very few outliers like watercress, water chestnuts, and taro, which all like boggy conditions, most fruits and vegetables prefer a moist root run and even like to dry out a bit between waterings. What's important to know is what's going on a couple inches *below* the surface.

While the finger test is the cheapest and easiest way to monitor soil moisture, there are moisture meters you can buy. They typically measure soil pH and light levels, in addition to moisture levels. They are relatively inexpensive and handy to have, particularly if you don't like sticking your fingers in the soil, but they're not essential.



*Using the finger test to check the moisture level*





*A moisture meter is an effective tool for checking moisture levels.*

## **WATERING DRY SOIL**

Sometimes you might find that even right after watering, the soil may still feel dry an inch or so below the soil surface. If this is the case, you might need to water your plants once, let the water soak in, and then water them again. The first watering will help break the surface tension of the soil particles, while the second watering will soak in deeper and reach the roots. Once you've done this, perform the finger test again to determine if the soil is adequately watered.

Whenever you do water, you'll want the water to go deep into the soil—the deeper the water, the deeper the roots will run for plants. If you only wet the top inch or so of soil, that's where the roots are going to be concentrated, and your plants won't have the deep root systems they need to withstand hot, dry conditions. What will happen on a hot day when the top couple inches of soil are heated up and dried out by the

sun? Wilting, and possibly dying. A deep root run will ensure that if the top couple of inches of soil get dry, the plant might still wilt, but it won't die. It will have the ability to pull moisture from deeper in the ground.

## **FIXING HYDROPHOBIC SOIL**

Depending on how dry your soil is or how much peat is in the soil, getting the soil wet could be difficult, even with heavy watering. Hydrophobic soil is soil that repels water rather than absorbing it. Hydrophobic soil can occur when the soil goes without water and nutrients for long periods of time, and the soil life—the microbes and worms—have died off or left for wetter pastures. Hydrophobic soil can't be fixed by simply watering as usual. If you encounter this issue, slowly sprinkle water on the soil surface, and then cover the area with 2 to 3 inches (5 to 8 cm) of compost. Spray the compost until it's saturated. Continue watering daily, and after a few days, the soil should be rehydrated and the compost will be on its way to adding life back to the soil, allowing the area to be planted again. Hydrophobia can be a problem in containers with peat-based potting mixes. Peat, though grown in damp bogs and remaining wet for hundreds of years is, ironically, very difficult to get wet again once it's dry. The best thing to do in this situation is to submerge the entire pot in a larger container of water for a couple of hours. The entire root ball may float up and out of the container, but as the peat absorbs the water, the root ball will become heavy and sink back down into the container. If it's new peat that is still in the bag and has dried out, it will be even more difficult to remoisten. In this situation, take a bucket or container with no holes, fill it with dry peat (use a wheelbarrow for larger amounts), and pour a large pot of boiling water over the peat. Mix it with a shovel or hoe, adding additional water as needed. Let the peat sit for several hours in the shade, and soon it should become workable again. To avoid this problem, store peat-based potting soils in airtight containers, and check the moisture levels every so often.





*Plants grown in containers have different watering needs than plants grown in the ground.*

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### **METHODS FOR EFFECTIVE WATERING**

Many of us often choose to spray our gardens with one thumb over the end of a hose or water our gardens along with our lawns by using the lawn sprinkler. While these methods can add moisture to the soil, there are better, more effective ways to water your vegetable garden.

### **HOW SHOULD YOU WATER?**

While you can't control the rain and humidity in your gardens, you can lower the incidences of fungal issues by watering gently from below. There are a few options you have for watering your plants from below, otherwise known as *low and slow*.

#### **Good: Bubbler or Trickle from a Hose**

You can place a hose on the ground and near a plant, adjust the hose to a trickle, and let it run until the area has been watered deeply, but you'll need to continue moving the hose, plant to plant, until the garden is watered thoroughly. To minimize erosion, you can purchase a bubbler that screws onto the hose end and helps soften the stream of water. If you don't want to purchase a bubbler, you can do it like my grandparents did it and simply place the end of the hose in a quart jar placed on its side to achieve the same results. This simple and inexpensive setup is an easy way to water your garden deeply from below; however, there is some risk of overwatering. Using a timer can help reduce the chances of overwatering, but you still may end up watering large areas that may not need the water, and there is a good chance of runoff if the ground isn't perfectly flat. There's also the time required to be constantly moving a hose, and you will get a large amount of evaporation if the soil surface is exposed to the sun and the air is wet.





*A quart-jar bubbler is a simple but effective way to water your plants.*

**Better: Soaker Hose**

A step up from using a bubbler is using a soaker hose, which is a long hose that has thousands of tiny holes that allow water to weep and soak the ground beneath. I have had mixed results with soaker hoses. If they are less than 20 feet (6 m) in length, they can be a good option, but any longer, and I have found that you can get uneven results with overwatering at the beginning of the hose and underwatering at the opposite end. You also can get a fair amount of evaporation with this method, resulting in the top of the soil under the hose and a few inches to each side of the hose being visibly damp but less so beyond that.





*A soaker hose will cover a little more area than a bubbler.*

### **Best: Drip Irrigation**

Hands down, drip irrigation is the best way to water your garden. You'll save water because you deliver the water precisely where it needs to go, with no runoff, no splashing, and virtually no evaporation. In fact, you might wonder if the drip system is even working because all you will see after running one is a pea-sized circle of dampness underneath the emitter. The rest of the ground will look dry. However, if you dig down, you will discover that the moisture travels from the top of the soil to the plant roots in a conical shape. The deeper the irrigation reaches, the wider the spread of moisture—just like a plant's root spread!

The icing on the cake is having an automated drip system with a timer. I used to spend eight to ten hours per week watering; now I spend zero hours watering. If you're worried about it being too expensive or too difficult to set up, don't be; you'll save money in the long run, and it's fairly simple to set up. (I have several videos on my YouTube channel that will walk you through the process, step by step.) Commonly asked

questions are how often and how long should you run the system. These are difficult to answer because it can change with the soil type, temperature, and the amount of rain and humidity you receive in your climate. I live in a Mediterranean climate, which means warm, dry summers with pretty much no rain. In fact, it rarely rains from May through September, so, of course, I need to run the drip more often in the summer and also leave it on for longer. Typically, every other day for 15 minutes is sufficient. Our winters are mild, with enough rain to supply plants with sufficient moisture most of the time, so my drip system is off for most of the winter. If we have a heat wave, which we sometimes do, I can run it manually, as needed. In other words, if you opt for a drip system, some trial and error will be necessary to determine how to use it in your garden, but once you get it figured out, you can sit back, relax, and pretty much never worry about watering again!



*For deep watering, a drip irrigation system is the optimum choice.*

## **WHEN SHOULD YOU WATER?**

Another common question I receive is when is the best time to water. If it's an emergency, and a plant is completely dry and wilting, the answer is *immediately*. If it isn't a water emergency, the best time to water is right around sunrise or in the early morning while the air is still cool. This will allow the water to run down into the soil and reach the roots of the plant without too much evaporation. Watering in the early morning will also make the water available to the plants throughout the day, so the plants will be able to deal better with the heat of the day.



## Why You Shouldn't Just Spray Your Garden with a Hose

Spraying a garden with a hose only wets the top of the soil unless you do it for a long period of time. Spraying also gets the leaves of the plants wet. While many gardeners might think this is ideal, you actually want to keep as much water off of the leaves as you can.

Leaving moisture on leaves for long periods of time can invite mildew and fungi that you don't want on your vegetables. Fungi are spread by spores, which are very lightweight particles that can blow through the air or be carried by water. Spores usually congregate in the soil beneath plants, where they can germinate and multiply, but when you water by spraying with a hose, you can splash spores up onto the leaves. If the leaves remain damp for too long, the spores can germinate on the leaf, take hold, and spread over the entire plant, eventually migrating to other plants in your garden.



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### **USING TRADITIONAL MULCH TO CONSERVE WATER**

Mulch can serve many purposes in the garden, but conserving water is one of the most important. And while many people think the expensive mulch that gets delivered by the truckload is the only available option, a variety of materials can be used as mulch, and you'll still get the same benefits.



*Mulch can be comprised of a variety of materials.*



## **WHAT IS TRADITIONAL MULCH?**

Traditional mulch is simply any material that is laid on top of the soil as a covering—think of it as a blanket for your soil. You can use almost anything as mulch: compost, straw, uncoated newspaper, uncoated cardboard, pine needles, dead leaves, wood chips, wood shavings, and even pebbles or gravel. (I would avoid using pebbles or gravel directly in the garden, however.) My favorite two mulches to use are homemade compost and straw.



*Uncoated cardboard with straw on top is a very effective option.*

### **Dead Leaves**

Dead leaves collected in fall and winter are a great choice for mulch, if you have access to them. In southern California, we don't have a lot of trees that lose their leaves in the fall and winter, so I never get enough dead leaves to use strictly as mulch. The leaves I do get I add to my compost pile. If you do have a lot of dead leaves, they'll keep moisture in the soil and will also add nutrients.

### **Grass Clippings**

Grass clippings can be used as mulch with one caveat: you should use them sparingly and in a layer that is less than 1 inch (2.5 cm) thick. Once wet, grass clippings will begin to break down and can create an almost impermeable layer that can keep water from getting to the soil, so it's important to use them sparingly. They can also smell putrid if they remain wet and begin to decompose.

### **Uncoated Brown Cardboard**

Uncoated brown cardboard will begin to break down in about three months and serves as great food for earthworms. It can look a little unsightly, however, so you can keep the garden looking neat and tidy by adding a layer of straw, leaves, or other material on top of the cardboard. Just be sure to remove any staples or tape before placing cardboard in the garden.

## **BENEFITS OF USING MULCH**

Mulch provides numerous benefits in the garden: it can help prevent disease, regulate soil temperature to protect soil in winter, add nutrients to the soil, and conserve water by reducing evaporation and keeping more moisture in the soil, which means you won't have to water as often. It can also provide food as it decays for the billions of microorganisms in the soil.

In hot weather and definitely in windy weather, evaporation increases significantly, so a thick layer of mulch will protect the soil from sun and wind. Water begins evaporating off of bare soil almost immediately, and mulch will help prevent this from happening by maintaining even soil



moisture. As the mulch decays, it will provide food for the billions of microorganisms in the soil. It will also keep the soil cooler on really hot days, which will keep plants happy and standing tall, instead of wilting in the miserable heat.





*It's important to make sure the mulch isn't in contact with the base of the stem.*

## **WHEN (AND HOW) TO ADD MULCH TO YOUR GARDEN**

Mulching twice per season is ideal, and the best times to mulch are late fall and early spring. A 3-inch-deep (8 cm) layer of natural compost is the ideal mulch, but any of the aforementioned options will work well. I never have enough homemade compost to add a 3-inch layer over my entire garden, so I usually add an inch or so and then add a couple of inches of straw on top of that. Note that you'll want to use straw and not hay, which contains many more weed seeds than straw, and those seeds will happily germinate and take up residence in your garden beds. While most straw does contain some seeds, it contains far less than hay, and in thick mulch, any weeds can very easily be pulled when they do sprout.

Fall and winter mulching will help prevent erosion from snow, ice, and rain throughout the winter. For these reasons, it's a great idea to mulch for the cold season, even if you live in a climate where winters prevent you from growing a garden. If you live in a climate with rainy, wet summers, erosion might be a summer issue as well, so a layer of mulch in the summer can be beneficial.

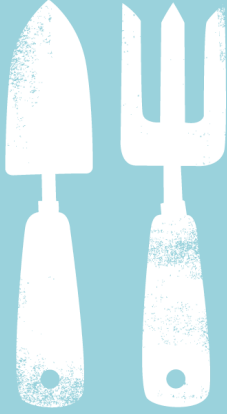
When using mulch around plants in wet, humid climates, make sure you keep a small space (about 1 inch [2.5 cm]) between the mulch and the main stem or trunk of the plant at ground level. Sometimes mulch can hold in too much moisture around the stem and cause fungal or bacterial issues.

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## CHAPTER 6

# PEST AND DISEASE MANAGEMENT



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## ORGANIC OPTIONS FOR PEST MANAGEMENT

Here are some of the most popular methods organic gardeners have traditionally used for controlling garden pests. There are positives and negatives to each of these options, so you'll need to decide which options will work best in your garden.



### HANDPICKING

Handpicking is the least intrusive way to deal with pests. Of course, this method works better for slow-moving caterpillars and larvae than, say, grasshoppers or white cabbage butterflies. But handpicking targets the pests and removes them without harming beneficial insects. It's best to hand pick in the early morning or late evening. Look at the undersides of leaves where the pests are usually hiding, and you should be able to find them. When you pick them off, be sure you destroy them or

transport them far from your garden. If you just throw them on the ground or over the fence, they're likely to come right back.

## **FLOATING ROW COVERS**

Floating row covers are plastic or polyester covers that keep out insects, while still allowing water, air, and light to reach plants. Some people (like me) don't like the look of their plants being covered by row covers, but they do work really well by creating a physical barrier between plants and the outside world. If a cabbage white butterfly can't see or get to the cabbage, their life cycle won't continue in your garden; they will need to go somewhere else to lay their eggs. For row covers to be effective, however, they must be put in place at planting time and kept in place until harvest. Unfortunately, row covers also can keep out beneficials, like pollinators, just as effectively as they can keep out the bad guys. So if you cover plants like squash to keep out the squash vine borer, you'll need to hand pollinate the squash flowers since the bees and other pollinators will also be excluded by the row covers and won't be able to reach the flowers.

## **TRAPS**

Traps work in a variety of ways. Yellow sticky traps attract insects and can trap them with a sticky coating. There are also light traps and bug zappers, but they can kill both good and bad bugs. Pheromone traps will attract specific insects using specific pheromones, so they're the best option, as you will only attract and trap the insects you are intending to kill.



## INSECTICIDAL SOAPS AND OILS

Organic pesticides like insecticidal soaps and oils are effective, nontoxic solutions for controlling unwanted pests in the garden, but they can also kill good bugs. If you choose to use these options, make sure you aren't using them as an all-over preventative and spraying the entire garden indiscriminately; instead, you should target problem areas only. Neem-oil is an effective option. It's pressed from the seeds and fruit of the neem tree, which is native to India, and it kills insects in two ways: it kills if it's ingested, which is why it works so well on bad bugs and not beneficials (beneficials typically aren't munching on your leaves; it's the pests that do that); and it works as any other horticultural oil does, by covering and smothering soft-bodied insects. The only drawback is that some beneficial larvae are likely to be killed by using neem-oil, so while I still recommend it as an organic pesticide if it's used judiciously and carefully, I no longer use neem-oil as a preventative, nor do I blanket the garden with it. You should avoid spraying it on plants like fennel,



dill, and milkweed, all of which are favorites of butterflies. Bees can also be harmed if sprayed directly, so I always spray in the early morning before the bees are out and about pollinating my plants. I also avoid spraying flowers because bees collect pollen and nectar from those flowers that they then take back to their hives.



## **BACILLUS THURINGIENSIS (BT)**

Bt, or *Bacillus thuringiensis*, is a microbe found naturally in soil. It makes proteins that are toxic to immature insect larvae, which makes it the ideal killing machine for caterpillar-type pests like tomato hornworm and cabbage white worm. When ingested, the toxins in the proteins are activated in the gut of the caterpillar, and these toxins begin to break down the digestive system, which causes the caterpillar to die of starvation or infection within hours or days. Bt is nontoxic to humans, animals, fish, birds, and basically anything else that is not a larval-type creature eating the leaves of your plants. But just as with neem-oil, all good things have a downside. Some of our favorite pollinators—

butterflies—start out as caterpillars, so Bt can impact butterfly larvae. I recommend it only if it's used carefully.

## **APPLYING ORGANIC INSECTICIDES**

No organic insecticide treatment method is completely off-limits, and there are times when, given a bad outbreak, multiple options may be necessary. However, before you treat your garden with any insecticides, you should make a careful assessment to determine which pests you have, and if the damage they are causing is extensive enough to warrant treatment. If you do decide to treat, treat only the affected plant(s) and not the entire garden.

### **Don't Overtreat Your Garden!**

As you implement companion planting, you will attract more beneficial insects to your garden. However, those beneficials will only stick around if they have a consistent food source, and a big component of that food source will be pest insects. If you kill all the pest insects with organic insecticides, the beneficials will have nothing to eat! Everything is about keeping balance in the garden. Spraying a few badly infested plants is much better than overtreating by spraying your entire garden. Your job as a gardener is to gently assist nature. Killing every last pest will work against that mission.



## **STEPS FOR TREATING YOUR PLANTS**

Follow these simple steps to safely apply organic pesticides in your garden. (Be sure to follow the instructions on the product packaging to ensure you mix the solution at the proper ratio.)





**Step 1:** Measure and add organic insecticide to a pump sprayer.



**Step 2:** Add the right balance of water to dilute the solution.





**Step 3:** Prime the sprayer to generate enough spray pressure that the sprayer will reach the affected plants.





**Step 4:** Thoroughly coat the stems and tops and bottoms of the leaves of affected plants only.

## **Tips for Applying Organic Insecticides**

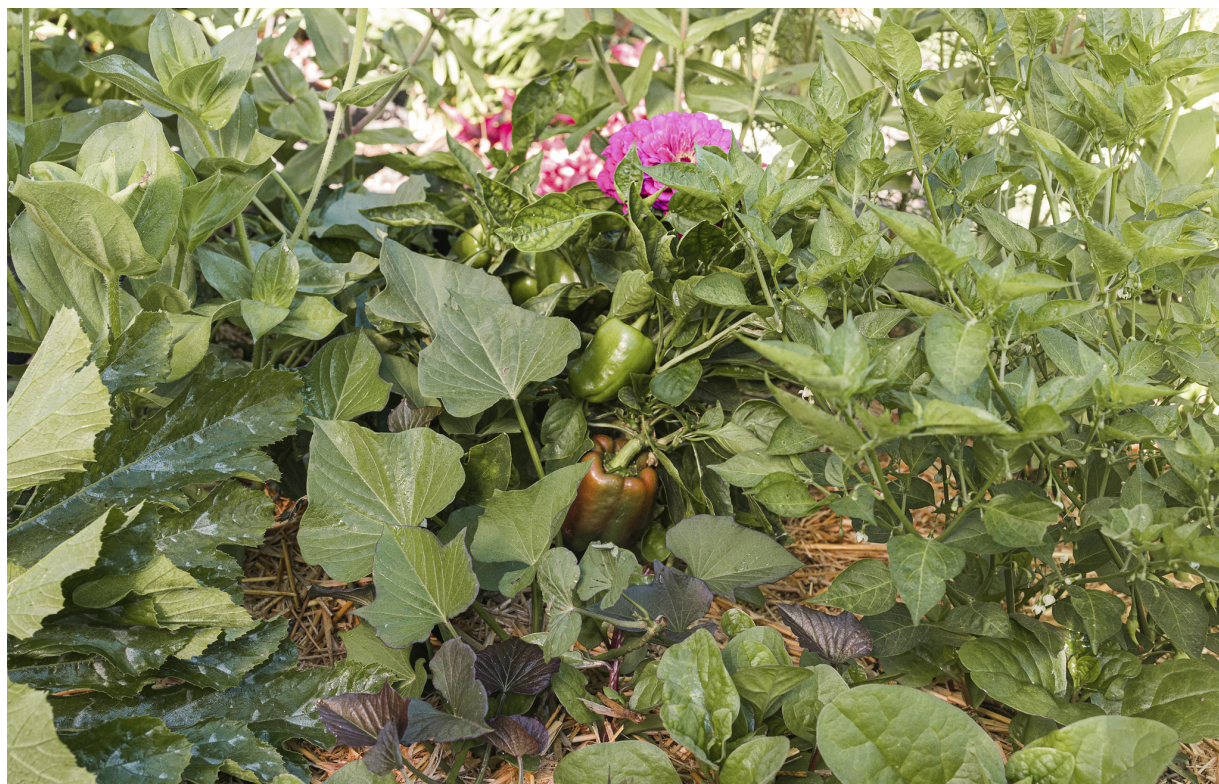
Follow these tips to get the most benefit from an organic insecticide.

- Only spot treat affected plants. This will help keep the delicate ecosystem in balance.
- Keep a close eye out while you are spraying to make sure you aren't inadvertently spraying beneficial insects.
- Check the progress after a few days to see if you've stopped or at least slowed the problem. You don't need to have 100 percent elimination to be successful. If the pests you've sprayed are still there but they're in smaller numbers, you can consider the treatment successful.
- Keep a watchful eye over the next several days and weeks to ensure the numbers continue to diminish or at least stay at the same level. If the numbers are lower or about the same, you may have done enough to bring back the balance. The beneficials should not be overwhelmed to the point where they can't do their jobs. If after five to seven days there is an increase in numbers, consider a second targeted application.
- Spraying an insecticide is also a good time to foliar feed affected plants, which will make them stronger and more resistant to pests. To do this, mix in some liquid organic fertilizer along with the organic insecticide.



## USING POLYCULTURE TO CREATE DIVERSITY

When you look at most of today's conventional farms, you'll see miles of one crop in a field—maybe it's wheat, maybe it's corn, maybe it's soybeans—but it's only one crop per field. This practice is called *monocropping* or *monoculture*, and it creates a very exclusive club for only one type of plant to thrive. If you are not the same plant, you're going to be eliminated. What we're aiming for in our companion gardens is *polycropping* or *polyculture*, which means you'll be growing at least two different crops or more together to create symbiotic relationships.



## THE BENEFITS OF POLYCULTURE

Nature is diverse. You don't see rows of any kind in nature. You also don't see huge expanses of any one type of plant and then nothing else. When you look at a forest, at first you might just see pine trees, but the forest floor is covered in ferns, columbine, wild berries, asters,

goldenrod, wild geranium—the list goes on and on. And all of those plants serve a purpose in that forest.

To illustrate how plants can benefit from polyculture, let's consider the fate of the cabbage white butterfly. The perk of being this species is that it has the ability to fly, but the downside is it will only live for a week or two. With that short of a lifespan, there's work to be done. It's a nice spring day and it's fluttering down a country road, when it rounds the corner to find a farm with three acres of nothing but cabbages. It's just hit the mother lode! There's no way it can lay eggs on all of those plants, but it's sure going to try! It doesn't really matter though, because the farmer will come by tomorrow and spray chemical insecticides that will kill the eggs, and maybe the butterfly too.

In the next scenario, the butterfly flutters into a backyard garden of someone who is gardening organically—but they have several neatly laid out rows of crops, including three rows of favorites: cabbage, broccoli, and cauliflower. Our butterfly swoops in to lay its eggs. And because this is an organic garden, the eggs have a better chance of hatching in about a week. But that's when a vigilant organic gardener will begin to see the damage from the caterpillars eating the leaves, so they might spray the leaves with an organic pesticide or choose to handpick the caterpillars off of the plants. Either way, it's going to be a whole lot of work for the gardener.

In the third scenario, the butterfly is flying around and comes to my garden. It looks around, but is a bit confused. It sees something that looks like a cabbage, but it's surrounded by all kinds of other plants. It might find a leaf here or there to lay its eggs on, but it's much more difficult work. Not to mention, there are carrots and parsley blooming in the garden, which have attracted parasitic wasps. So, even if the eggs hatch, the caterpillars will be parasitized and killed. I also have zinnias and sunflowers growing in my garden, and they attract robber flies, which are stealthy butterfly hunters, so my garden likely will be the last one it lays its eggs in. All of this happens because I set it up like that.

I've used polyculture to create a diverse growing environment where it's difficult for pests to take hold.

*Create diversity* is the first piece of advice I give to anyone when they ask what they should do to get started with companion planting. In some ways, it doesn't matter what you plant with your squash, tomatoes, and peppers. Of course, there are plants that will help deter specific pests and also attract specific pollinators, but the important point is that you should mix things up. As you learn and grow as a gardener, you will find the best plant combinations for your garden. During that learning process, keep in mind that the most important thing you can have in your garden is lots of vegetables, flowers, and herbs all sharing the same space. All of these plants will work together to create a symbiotic environment that will require less work for you, while producing excellent yields and also eliminating or greatly reducing the need to use chemicals in the garden.

## ATTRACTING GOOD INSECTS TO YOUR GARDEN

Seeing a bug you don't recognize on one of your well-tended crops can be unnerving; we've all seen plants taken down by pests in a very short period of time. But not every insect is a pest.

In fact, out of the 1.5 million insect species in the world, less than 3 percent are destructive. That leaves more than 97 percent that are not destructive, and most of those will actually help you in your gardening efforts.

## THE ROLE OF GOOD INSECTS

Beneficial insects will perform many jobs in your garden. Some will pollinate flowers, some will help break down organic waste into priceless compost, and some will be there to kill and eat the very bugs that are eating and possibly killing your garden (and your gardening spirit). Inviting the good guys in and fostering an environment for beneficial insects to thrive in your garden is an important key to success.

Pest management through *biological control* is our supreme goal with companion planting. Biological control is the control of a pest by the introduction of a natural enemy or predator. You can purchase beneficial insects from an insectary to target problem pests in your garden, but it's much better to attract predatory insects to your garden instead of purchasing them. Purchasing lacewings, ladybugs, praying mantis egg cases, parasitic wasp eggs, and several other beneficials, and introducing too many of them can tip the balance in the wrong direction. Praying mantises are stealthy hunters, but they are not picky about which bugs they eat—they eat them all, good and bad, so having a few in your garden can be wonderful, but releasing thousands of them can be devastating. Most commercially sold ladybugs are wild harvested, which means you won't know where they've come from and there's some risk that these foreign ladybugs can introduce a parasite that will

attack and kill or lower the reproduction rate of your native ladybugs. Also, many of the purchased ladybugs you might release may simply fly away unless you have a physical net or barrier of some kind to keep them in. Attracting predatory insects to your garden instead of introducing them is a much smarter approach!





*A ladybug visiting flowering radish*

## **ATTRACTING GOOD INSECTS**

Just having a pest in your garden will naturally attract their predators. So indiscriminately spraying a garden with insecticides, organic or not, might actually reduce or eliminate the pests, but it can also take away part of the food source for the predators, which means there is less for them to eat and they may go elsewhere. A balanced garden actually contains some pest insects to feed the predators. The goal of a healthy companion garden isn't to grow perfect plants with no holes; a few holes here and there likely means you have a healthy, thriving garden that will provide safe produce to you and your family.

### **Grow Umbel Flowers**

Because the vast majority of predatory insects also feed on pollen and nectar, we need to offer them plenty of flowers in our vegetable garden in a wide variety of shapes and sizes. Insect mouthparts come in all shapes and sizes, and so do flowers! Umbel flowers, like those of the carrot family, have multiple flowers spread across an umbrella-shaped inflorescence. These flowers attract hoverflies, ladybugs, lacewings, and parasitic wasps.



*Yarrow, an umbel flower*

### **Grow Daisy-Shaped Flowers**

Daisy-shaped flowers like zinnias attract bees, hoverflies, syrphid flies, tachinid flies, and parasitic wasps, so you should plant a variety of this type of flower in and among your vegetables. Not only will you be laying out the welcome mat for your helper bugs, you'll have a much prettier garden to boot. It's always a good idea to find out which crops are relished by which pests and then grow flowers nearby that attracts the pests' natural predators.





*Chamomile, a daisy-shaped flower*

### **Plant Living Mulch**

Once you've attracted beneficials to your garden with food, you'll want them to stay. If you provide them shelter as well, they won't just eat and run. Low-growing cover crops, or living mulch, will provide protection throughout the summer, and leaving ornamental grasses left standing through the winter will provide lots of nooks and crannies for our beneficials to seek shelter from the cold.



## USING TRAP CROPS TO CONTROL PESTS

Sometimes pest insects chew up crops simply because it's all that's available in our garden, but if you provide more desirable choices for the pests, sometimes the crops you want to protect can be spared. With trap cropping, you'll grow a specific group of plants, not for harvesting but simply to draw pests away from the crops you do want to harvest.



*Nasturtium*

## BENEFITS OF TRAP CROPPING

Trap cropping reduces the need for pesticides, even organic pesticides. And by not using pesticides, you can preserve the beneficial insects that could inadvertently be killed off if you use pesticides in your garden. You can also attract beneficials to your garden simply by increasing the pest activity in your trap crops. By using trap cropping, you will naturally have an increase in certain pests that are attracted by your trap crop. When those pests increase, typically so do their predators, which

is a good thing. You can help this process along by planting companion plants that will attract beneficial insects to prey on the pests that are munching on the trap crop. For example, traditionally you plant nasturtiums as a trap crop for aphids. If you have a crop that is prone to aphid attack, like brussels sprouts, you want to plant nasturtiums around the brussels sprouts to lure the aphids away from the brussels sprouts. You could also then plant companions like flowering carrot, zinnia, and sunflowers, all of which will attract ladybugs to the area, and ladybugs are predators of aphids. So by planting a combination of trap crops and companions, you'll be protecting your brussels sprouts and also creating an environment where beneficial insects will populate and protect your garden. Just as it is with companion planting, adding trap crops helps create and maintain the delicate balance in your backyard ecosystem.

## SELECTING TRAP CROPS

It's important to know which insects are drawn to which trap crops. The following table lists some common trap crops, along with the crops they protect, the pests they draw away from the protected crops, and the companions that can be used in conjunction with the trap crops to attract beneficial predators.

PESTS	CROPS THEY ATTACK	BENEFICIAL TRAP CROP	BENEFICIAL COMPANIONS
Tomato hornworm	Tomatoes, peppers, eggplant	Dill	Dill
Cabbage worm	Brassicas	Collards	Lavender
Flea beetle	Nightshades and brassicas	Chinese mustard	Dill, fennel
Squash vine borer, squash bug	Squash and melons	Blue Hubbard squash	Dill, carrots, parsley, radish
Spider mite	Fruit trees, berries, cucumbers, tomatoes, beans, peas, lettuces	Bush beans	Cosmos, yarrow
Japanese beetle	Multiple	Borage	Sweet alyssum
Whitefly	Brassicas, tomatoes, peppers	Eggplant	Parsley, Queen Anne's lace

## PLANTING TRAP CROPS

To get optimum results, it's important to locate trap crops at the appropriate distances from the main crops. There are certain pests that

travel far and wide to find food, and there are some that don't venture very far. Very small pests like aphids, flea beetles, and mites typically will stick to the immediate area. For these small pests, you'll want to locate a trap crop in and among the main crop or at most 3 feet (1 m) away from it. Larger pests like squash bugs, vine borers, Colorado potato beetles, and Japanese beetles will be more adventurous in their search for food. For these larger pests, you'll want to plant trap crops about 10 feet (3 m) away from the crop you're trying to protect.

How much of a trap crop you plant will depend on the size of the main crop. A good rule to follow is to plant about 10 to 20 percent of the size of the crop you are protecting. Also, the planting of trap crops will need to be timed to ensure the trap crops are the right size when they're needed to perform their task, so typically you'll want to plant your trap crop about three to four weeks ahead of planting the main crop. This will enable the trap crop to get established.





*Dill*



## COMMON GARDEN PESTS

These are some of the most common garden pests that you're likely to encounter, along with some companion planting strategies you can use to minimize their damage and also attract their natural predators.

### APHID

Aphids are common, and virtually anyone who has a garden will encounter them. Aphids are easy to spot because there are rarely one or two; they usually appear in large numbers and come in almost every color. Large plants can usually withstand an aphid attack and survive; however, seedlings and new transplants can easily be killed. Other than seeing the aphids themselves, their damage will produce distorted, curled leaves, and you may see a sticky grey dust on the leaves, as well. Rarely do you need to resort to organic insecticides like neem-oil to control them. Many times you can simply blast them off of your plants with a hose. Any left after the blast can be taken care of by parasitic wasps and ladybugs, both of which can be attracted to the area by growing flowering carrot, dill, and fennel. You can also plant a trap crop of nasturtiums about 10 feet (3 m) from your plants, which will draw the aphids away from your crops. And consider interplanting onions, garlic, or chives, whose scents will repel the aphids.



*Aphids*

## **CABBAGE WORM**

Those little white butterflies you see flitting around your brassicas are not “good” bugs. They lay eggs that produce cabbage worms, and these little pests can decimate your plants in just a couple of days. You can

spot the damage by looking for chewed holes in the leaves of brassicas like broccoli, cauliflower, and cabbage. You can pick them off by hand, or, in the event of an infestation, you can use Bt spray. A good companion planting strategy is to mix your brassicas in with other crops like celery, carrots, and beets, or living mulches like crimson clover, all of which will confuse the cabbage butterflies into laying their eggs elsewhere. Underplanting with sweet alyssum will attract parasitic wasps, which will lay their eggs under the cabbage worms' skin. The larvae will then eat the worm from the inside.





*Cabbage worm*

## **COLORADO POTATO BEETLE**

These brown-, black-, and white-striped beetles eat the leaves of nightshades like tomatoes, potatoes, eggplants, and peppers. They can eat an entire plant in days. Bt will kill the larvae, as will damsel bugs,



which can be attracted to the area by planting lavender or low-growing thyme among your crops. Assassin bugs can kill adult beetles and will also be attracted by planting a good variety of companion plants.



*Colorado potato beetle*

## **STRIPED CUCUMBER BEETLE**

Striped cucumber beetles are easy to identify. They are about  $\frac{1}{4}$  inch (6 mm) long and have yellow and black stripes running from their head along the full length of their body. They enjoy feasting on the leaves, seeds, and flowers of all cucurbits, including squash, melons, and cucumbers. You can also find them on beans, corn, tomatoes, and potatoes. Companion planting with marigolds is said to deter the cucumber beetle. Creating polyculture in your garden will attract the wolf spider, which is a natural predator of cucumber beetles. Ground

beetles are another predator you can attract to your garden by providing shelter: stones, bricks, or small pieces of wood placed on top of your mulch will make comfortable living spaces for ground beetles. To prevent cucumber beetles, plant a trap crop of blue Hubbard squash 3 to 8 feet (1 to 3 m) from the main crop. They like blue Hubbard squash more than any other variety of squash and will attack those instead of the main crop.



*Striped cucumber beetle*

## **FLEA BEETLE**

Flea beetles are very tiny black beetles that look and hop like large fleas. They attack members of the nightshade family including tomatoes, potatoes, eggplant, and peppers, and also damage crops like corn and brassicas. The damage they create looks like tiny holes punched in the



plant's leaves. Usually the damage is on new leaves, seedlings, and transplants. You can thwart this pest by providing a trap crop of radishes and pak choi planted in and among your main crop.



*Flea beetles*

## LEAF MINER

The name *leaf miner* refers to any species of larvae (usually moths, flies, and some beetles) that live in and eat the tissue of plant leaves. They live between the two outer layers of the leaf and tunnel their way through the leaf. You can find them on a wide range of crops, and the damage will be evident as little squiggly lines all over the leaves. They are difficult to control with organic insecticides because they are protected between the leaf's layers. Companion planting to the rescue! You can attract parasitic wasps to your garden by interplanting with dill,

sweet alyssum, and yarrow. Parasitic wasps find these larvae and inject them through the leaf with eggs. The wasp larvae will hatch and eat the leaf miner larvae.



*Leaf miner*

## **SPIDER MITE**

Spider mites are really tiny pests that live in large groups on the undersides of leaves. The damage looks like thousands of yellow spots and if infested, entire leaves can take on a bronze appearance. You may also see very fine webbing throughout the plant. Spider mites can be controlled with neem-oil, but it takes diligence. Apply neem-oil every



three days until you see the spider mite population dwindling. Companion planting a variety of bushy plants like crimson clover throughout the garden will provide shelter for big-eyed bugs. One big-eyed bug can eat close to 50 spider mites per day.



*Spider mite*

## **SQUASH BUG**

Squash bugs can be found on all members of the cucurbit family, including squash, melons, and cucumbers. They are about ½ inch (13 mm) long and look similar to stink bugs but with longer bodies. The



damage they create will show as yellow spots that turn brown. Later, the entire leaf will crisp up and die completely. Their activity can kill smaller plants, and they will also eat the fruit. Early detection is crucial. Find the egg masses on the underside of leaves and crush them. Handpick the adults and toss them in a bucket of soapy water. You can also lay a small piece of wood or cardboard on the ground; overnight the bugs will congregate underneath, and in the morning, they can be crushed or take a soapy bath. Neem-oil can help, but it works better on babies than adults. Companion planting dill and parsley, and letting them flower, will attract tachinid flies, a natural predator of squash bugs.



*Squash bug*

## **SQUASH VINE BORER**

The adult squash vine borer is a moth about ½ inch (13 mm) long. Its body is black with orange-red markings, and its wings are clear and make the moth look more like a hornet. It lays its eggs on the stems of cucurbit plants (squash, mainly, but also cucumbers and melons). When the eggs hatch, the larvae burrow into the stem and eat the stem from the inside, cutting off water and nutrients to the rest of the plant. You will notice the plant start to wilt and die, and many times it is too late to do anything once it reaches this stage. Prevention is key to controlling these devastating pests. Start at planting time with floating row covers, and leave them on until the plant starts to flower. Once the covers are removed, wrap aluminum foil around the stem to place another physical barrier between the stem and the moth. Be sure to wrap the stem up to the first leaves, and then bury the bottom of the foil below the soil surface. You can inject Bt into the borer stem hole, and that can sometimes stop the burrowing larvae from creating further damage. Planting sweet alyssum, dill, and fennel, and letting them flower, will attract parasitic wasps, which will lay their eggs inside the eggs of squash vine borers, stopping the problem before the borers even hatch.





*Squash vine borer*

## **TOMATO HORNWORM**

Hornworms are chubby, green worms with a red horn on the back end and are 4 to 5 inches (10 to 13 cm) long. They can strip the leaves off of your plants in a couple of days. You will notice missing leaves and probably dark green, almost black droppings on the leaves below the damage. Their main target is tomato plants, but they can also be found on eggplants and peppers. It is very effective but really not needed. It's easy to pick the large worms off the plants if you see them. The best trick is to go out at night with a black light flashlight. The worms glow



in ultraviolet light, making finding them simple. I always companion plant my tomatoes with basil. Basil has such a strong scent that it masks the scent of the tomato plants. The spotted hawk moth (the full-grown version of the tomato hornworm) has a more difficult time finding your tomato plants by smell when other pungent smells are in the area. Planting carrots, celery, dill, and fennel in your garden will attract parasitic wasps that will lay their eggs under the skin of the tomato hornworm. The larvae will then feed on the worm, which will kill it and stop the life cycle.



*Tomato hornworm*



## WHITEFLY

What's more embarrassing to a gardener than guests brushing by your plants and raising a cloud of whiteflies? More than an embarrassment, whiteflies suck the juices from your plant leaves, causing them to yellow and die. Whiteflies prey upon a wide variety of plants. When you have a huge infestation, you will start to see white "beards" hanging from the undersides of leaves. Neem-oil works well if you spot treat the undersides of leaves. You can also attract damsel bugs (a natural predator of whiteflies) to your garden by planting lavender and low-growing thyme.



*Whiteflies*



## HOW COMPANION PLANTING CAN HELP PREVENT DISEASE

I would love to be able to tell you there is overwhelming evidence that companion planting will cure any disease that can plague your garden, but unfortunately, I cannot. I can, however, tell you that when coupled with some of the methods outlined in this chapter, companion planting can play a key role in minimizing the impact many diseases will have in your vegetable garden.



## USING COMPANION PLANTS AS SOIL COVERS

Companion planting may play a role in the prevention of diseases. While this is still an area of ongoing research, there are many evidence-based strategies you can put to use in your garden right now. Growing shorter plants like thyme, oregano, basil, and certain clovers among taller crops can provide cover over soil so that water from rain or

overhead watering with a hose or sprinkler doesn't hit the ground with full force and cause splash-up from the soil (where diseases may be lying in wait). That splash-up can take diseases up to the leaves, where it can flourish and multiply.

## **REDUCING FOLIAR DISEASES**

Companion planting plants like hairy vetch can actually reduce foliar diseases, in addition to providing plants with nitrogen, since vetch is a legume. To put this into practice, sow hairy vetch seed in fall in the same place you want to plant your tomatoes in spring. You'll want to sow the vetch at least four to six weeks prior to your first frost date, since hairy vetch can be killed in cold winter climates. In milder winter climates, you can let hairy vetch grow through the winter and then cut it down in the spring before it sets seed. In either climate type, you should leave the plants to lie right on the ground after they're cut down or killed and then plant your tomatoes right through them. (This method was tested by the USDA and performed so well that many researchers and farmers are expanding it to other types of crops.)

## **PREVENTING DISEASE SPREAD FROM PESTS**

Throughout this book we've talked about using companion planting to repel pests or to attract beneficial predators that will prey upon pests. Companion planting used in this way can limit the spread of disease, since pests can transfer disease from one plant to another. Just as damaged areas on a plant can give disease a foothold to enter the plant and take hold, keeping pests away or having them attacked and eaten by beneficial insects will go a long way toward keeping your plants healthy and disease-free.

## **PREVENTING SOILBORNE DISEASES**

Soilborne diseases like root rot, fusarium wilt, and verticillium wilt enter plants through their root systems. Companion planting can help in this situation, but again, only as a preventative. Once the disease has



entered the plant systemically (through the roots), the plant will not be able to be saved.

## **USING BIOFUMIGATION**

Biofumigation is an organic treatment method that involves incorporating chopped-up plants of the brassica family (cauliflower, broccoli, and mustard) into soil to kill off soilborne diseases. Brassicas, as well as rapeseed and Sudan grass, all contain chemicals and enzymes in their cell walls that can be effective biofumigants. These chemicals and enzymes don't intermix in intact plants; however, a 2013 study from Penn State University showed that when these plants are grown as cover crops and then mowed into small pieces, the enzymes and chemicals can combine to become a potent biofumigant. Once the chopped plants are tilled into the soil, the chemical-enzyme combination can actually kill some soilborne diseases, even before main crops are planted. The study also noted that the chopped matter should be incorporated into the soil within 15 minutes; any later and the compounds can become less effective. In addition, the study recommended soaking the soil surface with water after the plant matter has been tilled under to help the compounds work more effectively.

## **FIRST STEPS FOR PREVENTING DISEASE IN YOUR GARDEN**

Disease can be a scary thing in the garden. It can come on quickly, and some gardeners have no idea how to identify a disease, let alone treat it properly. With some prevention and traditional organic strategies, however, you can stop the spread of disease before it even starts.

### **MAINTAIN A CLEAN GARDEN**

Every few days, take a stroll through your garden with some clippers and a bucket, and trim off any old, yellowing, or diseased leaves. Taking this step will greatly reduce disease in your garden. When you trim off old, dying, or diseased leaves, be sure to throw them in the trash and not just on the ground: the disease can spread to your other plants. Unless your compost is a “hot” pile, you should never add diseased plants to your compost; you will just be spreading the disease next year when you shovel the compost into the garden beds.

### **TRIM DENSE FOLIAGE AND SPACE YOUR PLANTS PROPERLY**

As you walk around your garden, take note of particularly dense foliage and trim it back. The denser the foliage (especially in warm, humid climates), the more likely disease is to take hold. Dense foliage holds moisture by reducing airflow through the plants. It's okay to cut off perfectly healthy leaves on a plant, just never remove more than one third of the plant's leaves at a time, and don't cut off the growing tips unless you are pinching to create bushier, more compact plants, like with peppers. Try to take the leaves from the inside of the plant so it has a more open, airy appearance. For these same reasons, maintaining proper spacing between plants is important. If plants are packed in and growing into each other, you're likely to have more disease issues because it will be easier for one plant to pass disease on to the next.



*Trimming affected foliage is a good first step in preventing a diseased garden.*

## **KEEP PLANTS WATERED WELL**

Keeping your plants watered and giving them the correct amount of sunlight will make them stronger and healthier. And the stronger and healthier the plant, the more likely it will be to resist any disease that comes knocking. Keep the soil evenly moist and grow your vegetables in a minimum of six to eight hours of direct sunlight each day.

## **PLANT DISEASE-RESISTANT VARIETIES**

If you know that certain varieties of plants are susceptible to disease in your area, look for disease-resistant varieties. Certain hybrids and even some heirlooms are more naturally resistant to some diseases than other varieties of the same plant.





*Overgrown plantings are a breeding ground for disease.*

## **MULCH REGULARLY**

I cannot overemphasize the importance of mulching your garden, which can help control the spread of soilborne diseases. There are millions of pathogens in your soil, and they can build up year after year, especially if you grow the same crops in the same places year after year. When you water (unless you're using drip irrigation), you can splash these pathogens from the soil up onto your plants, where they can spread and eventually take down the entire plant. Mulch creates a physical barrier between soil pathogens and your plants. Ideally, you should add 3 inches (8 cm) of mulch in your beds in spring and again in fall if you grow through the winter.



## USE AN ORGANIC FUNGICIDE

If fungi is a problem in your garden, you can make your own fungicides using baking soda or hydrogen peroxide. Baking soda on plant leaves changes the pH and creates an inhospitable environment for fungi to grow. To create baking soda fungicide, combine 3 tablespoons of baking soda with 1 gallon (3.75 L) of water in a sprayer and then add a few drops of dish soap and 1 tablespoon of cooking oil. Be sure to spray the tops and bottoms of the leaves. Another fungicide home remedy you can try is hydrogen peroxide. In a sprayer, mix 3 to 6 tablespoons of 3 percent hydrogen peroxide to 1 gallon (3.75 L) of water. Spray the tops and bottoms of the plant leaves. Neither of these methods are necessarily preventatives, so you should begin using them at the first sign of disease, and then continue applying them every five to seven days until you see that the disease is eradicated.

There also are some organic fungicide options you can consider trying. If you opt for a store-bought solution, look for organic fungicides that include copper and sulfur as the main ingredients.

## **USING CROP ROTATION TO CONTROL PESTS AND DISEASE**

Crop rotation is one of the oldest agricultural practices still in use today and for good reason: certain pests and diseases like certain types of plants, and if you grow the same type of plant in the same location year after year, pests and especially diseases will build up in that location and can eventually become a problem. By rotating crops each growing season, you can eliminate some of these potential problems.

### **THE BENEFITS OF CROP ROTATION**

If pests overwinter in the soil or if a soilborne disease is present and you plant the same crops in that same soil every year, you are creating the potential for those pests and diseases to thrive and ruin your crops.

Crop rotation can help solve this problem by switching things up from year to year, ensuring the same crops only arrive back at the original bed location every four years. During that span, the pests and disease that thrived because of the presence of the original crops will be diminished or will have disappeared.

Another benefit of crop rotation is soil fertility. While one crop may leach more of a certain nutrient from the soil, other crops will take less of that nutrient and also return some of the original nutrients to the soil, all of which helps create a balance in the soil makeup. Planting the same bed of peppers in the same location every year may yield a bumper crop one year but yield barely any peppers the next year because the first-year crop took the nutrients, so the next year the soil is depleted of those nutrients. Unless you replace those nutrients in the form of a thick layer of high-quality, homemade compost, the soil quality will be poorer the following year because the nutrients have been further depleted by growing the same crop.



*Tarnished plant bug*

## **TRADITIONAL CROP ROTATION PRACTICES**

Traditional crop rotation requires knowledge of the vegetable plant families:

- **Alliaceae** The alliums include chives, garlic, onions, and shallots.
- **Solanaceae** This is the nightshade family and is probably the most popular family in the garden. It includes tomatoes, peppers, eggplant, and potatoes.
- **Cucurbitaceae** The cucurbit family is represented by over 900 species, including cucumbers, gourds, melons, summer and winter squash, and zucchini.
- **Fabaceae** The legume family contains the all-important nitrogen-fixing plants like alfalfa, beans, cowpeas, clovers, hairy vetch, peas, and peanuts.
- **Brassicaceae** The brassicas are cool season crops that include broccoli, brussels sprouts, cabbage, cauliflower, collard greens, mustard, kale, kohlrabi, radishes, and turnips.

If you are following traditional crop rotation practices, you will need to designate sections of your garden for each of the vegetable plant families. The following year, you will rotate the plantings and each of the families will move on to a new section. The process is repeated until after four or five years, the original crop ends up back in the space it started in.

While this process seems simple enough, you'll also need to track which family each crop belongs to. And you'll have to take into account which families grow best in the space occupied by the previous tenant and which crop will not do well if it followed the previous tenant. While traditional crop rotation practices are effective, they can be challenging for an everyday gardener to manage. Many gardeners (myself included) have often given up in the second year of this practice because it can become challenging to manage. With that said, many gardeners still prefer to use this method to manage their crops, and it can be effective. I've found a more effective method that is easier to manage called *4-step crop rotation*.



## USING 4-STEP CROP ROTATION (LEGUME-LEAF-FRUIT-ROOT)

So how can you take advantage of the many benefits of crop rotation but without it all getting too complicated? I came across a method created by Cynthia Hizer, who wrote about it in an article published in the December 1996 issue of *Kitchen Gardener Magazine*. I believe it's an easier method to implement than traditional crop rotation, and all of the important considerations are still taken into account. All you need to remember is *legume-leaf-fruit-root*.

Working with just one location, here's how to implement 4-step crop rotation:

- **Year 1:** Plant legumes (*alfalfa, beans, cowpeas, clovers, hairy vetch, peas, or peanuts*). By planting legumes first, you will be fixing nitrogen in the soil.
- **Year 2:** Plant leaf vegetables (*lettuces, greens, herbs, spinach, broccoli, brussels sprouts, cabbage, cauliflower, collard greens, mustard, kale, or kohlrabi*). These crops are grown for their leaves, and they need lots of nitrogen to develop all of those leaves.
- **Year 3:** Plant fruits (*tomatoes, peppers, eggplant, squash, melons, gourds, and cucumbers*). Fruits come next in the rotation because they need less nitrogen but more phosphorus, which the leaf vegetables didn't take too much of from the soil.
- **Year 4:** Plant root crops (*garlic, onions, radish, turnips, carrots, or beets*). Root crops come last in the rotation because they need even less nitrogen and phosphorus than the previous occupants, but they do need lots of potassium, which the others tenants didn't use up.

After year 4, the legumes will be rotated back to the original location to add the nitrogen back to the soil, and the cycle then starts all over again. Like traditional crop rotation, this method switches up the planting in a way that limits disease buildup because the same plant families (more or less) are not returning to the same space for four years, giving the pests

and diseases time to dissipate. In my opinion, this process is much simpler than the traditional crop rotation practice, and it requires less work.

The bottom line is you should mix things up from year to year to get the best results for the least amount of effort. Your rotation practices don't have to be perfect. You just need to try to switch things up as best you can, keep an eye out for disease and pests, and make any changes accordingly. If you choose not to rotate your crops, at a minimum you should add a 3 inch (8 cm) layer of compost on top of your beds at the start of each growing season. This will add some nutrients back to the soil and also provide a barrier between the soil and the plant leaves.

## **COMPANION PLANTS FOR DISEASE MANAGEMENT**

There are numerous plants that can help control disease in the garden, but here are some of the most effective options.

### **CUCUMBERS**

Cucumbers and tomatoes make great companions for many reasons. But in terms of disease management, the large leaves and quick-spreading growth habit of cucumbers is ideal for preventing water from splashing soil up onto tomato leaves, which can foster all types of disease.

Cucumbers like warm weather and sunshine, just as tomatoes do. If you plant them both at the same time, they will grow at the correct rate to perform well for disease management. It's best to plant cucumbers on the sunny sides of tomato plants so they can get the maximum amount of direct sunlight hours and not be shaded for half of the day by the tomato plants, which will be much taller. As a bonus, large, flat cucumber leaves will shade the ground to provide weed protection and reduce water evaporation from the soil. Cucumbers are also allelopathic, which means they can help suppress the germination of weed seeds.



*Cucumber leaves offer a multitude of benefits to tomato plants.*

## HAIRY VETCH

When grown as a cover crop before the warm season begins, hairy vetch has been shown to reduce fungal disease among certain summer vegetables. Hairy vetch is sown in fall and then left to grow until spring (or in cold winter climates, until it is killed by winter cold). In mild winter climates, it will grow through winter and will need to be cut to the ground in spring, just as it's beginning to bloom. You can till the cut vetch into the soil and let it sit for a few weeks to decompose. Once it's decomposed, you can plant any summer crops that can fall victim to fungal diseases. If you are practicing no-dig gardening, you can cut hairy vetch down to the ground and leave it on top of the soil. In a few weeks, you can plant your crops right through it, just as you would plant through mulch.

As an added benefit, in winter hairy vetch will protect soil from freezing and thawing, and help prevent soil erosion. The remaining hairy vetch roots will give mycorrhizae fungi space to colonize in winter, which will keep their numbers high. Because hairy vetch is a legume, it also fixes nitrogen in the soil for the next crop to take advantage of.





*Hairy vetch*

## **MUSTARD**

Mustard is one of the most studied and most potent biofumigants known to organic gardeners. Biofumigation is an organic treatment method that involves the incorporation of chopped-up members of the brassica family into the soil. When the compounds are released into the soil, they can suppress soilborne diseases such as verticillium wilt and blight, which can affect a wide range of garden crops including tomatoes, potatoes, peppers, eggplant, cucumbers, pumpkins, and watermelon. Many crops can be saved by using a biofumigant like mustard, instead of a synthetic fungicide.



*Mustard*

## **USING BIOFUMIGATION TO CONTROL DISEASE**

Biofumigation can be an effective added step for controlling disease. Here are some simple steps for using mustard as a biofumigant in your garden.

1. Sow the mustard seed in early spring, just as soon as the soil can be worked, and let it grow until it begins to flower, at which point the compounds you'll want to transfer from the plant to the soil are at

their highest ratio. (I recommend using a mustard variety that has been well studied, like 'Caliente'.)

2. Once the mustard begins to flower, mow it down. You may have to mow over it two or three times to completely pulverize the plants. (The smaller the plant particles, the better the process will work.)
3. Once you have the plants sufficiently chopped up, immediately till the particles into the soil.
4. If you have access to a soil roller, roll over the top of the ground to seal in the gasses that will be produced by the mustard. If you don't have a soil roller, place a large piece of plywood on top of the soil surface and then use your body weight to pack down the soil under the plywood.
5. Water the area thoroughly. This will create the final seal for the mustard gasses to do their work.

You should wait 10 to 12 days before planting your crops in the treated area. This period will give the gasses time to work and then dissipate. Planting any earlier could cause your plants to be stunted. At planting time, lightly work the area by hand, but don't do any more tilling, as that can work the treated soil deeper into the ground and also pull deeper, untreated soil up to the surface.



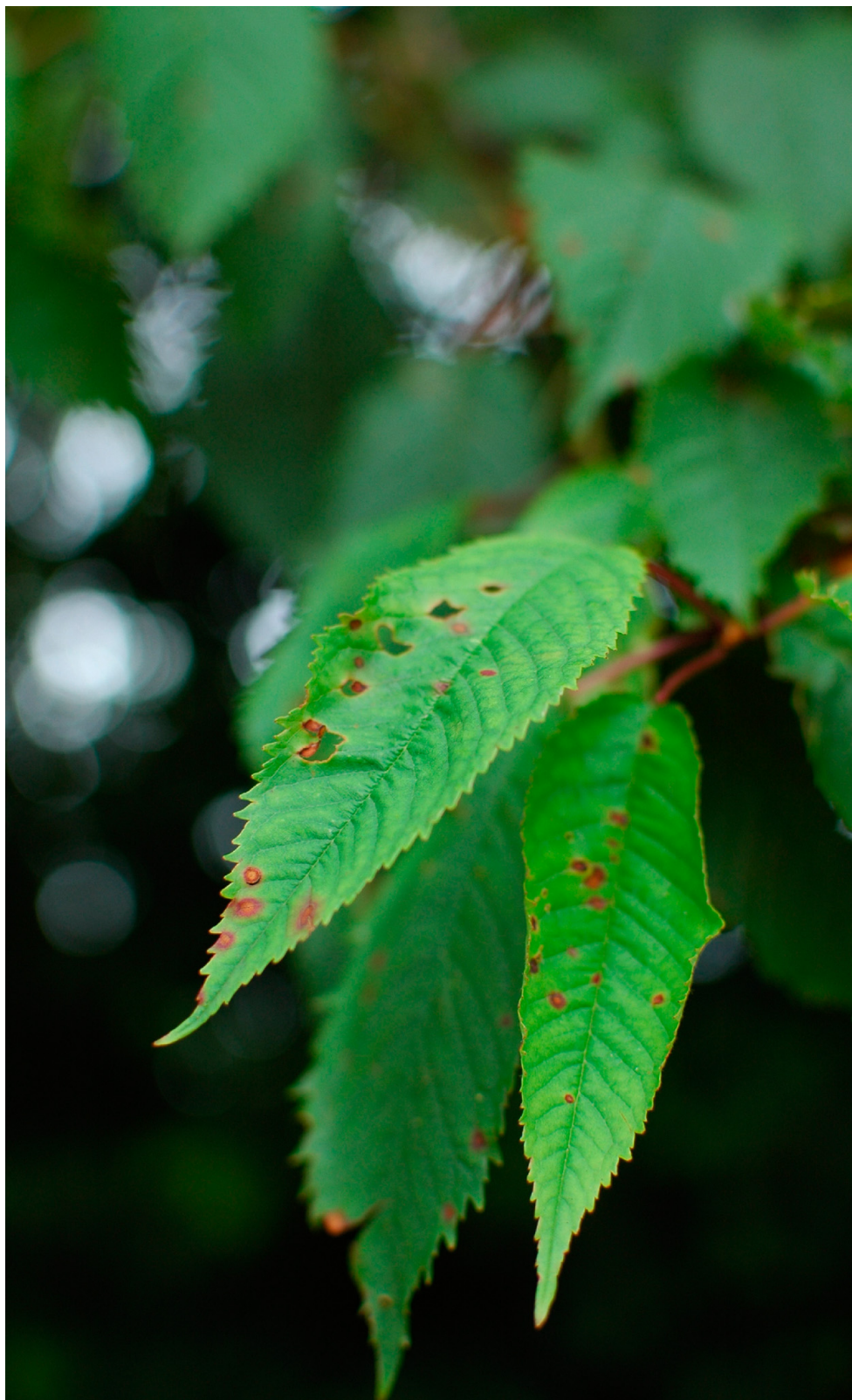
## **COMMON GARDEN DISEASES**

Here are some of the most common diseases that organic gardeners encounter.

### **BACTERIAL LEAF SPOT**

Crops most susceptible to bacterial leaf spot are beets, eggplant, lettuce, peppers, and tomatoes. Telltale symptoms of bacterial leaf spot are water-soaked lesions on foliage that get darker with age, eventually turning black. The lesions may be surrounded by a yellow halo and usually are bordered by the veins of the leaf. In a bad outbreak, however, the entire leaf can be affected and will eventually wither and fall off. This disease is on the leaf surface and is easily spread by water splashing from one plant to the next or from one leaf to the next. If your crops get this disease, remove the plant from the garden, and wash your hands after handling it and before handling an uninfected plant. Avoid overhead watering (sprinkling), and prune heavy foliage plants like tomatoes to increase airflow through the plant. Drip irrigation is one way to water from below and decrease the amount of time leaves are damp. Spraying an organic copper-based product as a preventative is a good idea if you live in an area prone to this disease.





*Bacterial leaf spot*

## BLOSSOM-END ROT

Blossom-end rot is quite common in peppers, squash, and tomatoes. It's a very easy problem to diagnose and fix. New fruits will develop a soft, watery, brownish-black blossom end that can ruin the entire fruit.

Blossom-end rot is caused by a lack of calcium in the plant and *not*, as is commonly thought, a lack of calcium in the soil, which can be an issue in rare cases. In most cases, there is enough calcium in the soil, but the plant just can't get to it. Lack of water is almost always the cause of this issue. The plant uses water to pull calcium out of the soil and up into itself, so if there's no water, there's no calcium movement. Every time I've had plants with blossom-end rot, it's been because of a watering issue, so keep the ground consistently moist and you will steer clear of it.



*Blossom-end rot*

## **CURLY TOP VIRUS**

Curly top virus affects many garden crops including beans, peppers, pumpkins, spinach, squash, and tomatoes. It's actually caused by several viruses, but usually presents itself in the newer top leaves. The leaves will twist and curl upward. Curly top virus doesn't necessarily spread from plant to plant; it's a systemic problem and is caused by the leafhopper bug. If the leafhopper has already chewed on an affected plant and then chews on an unaffected plant, the unaffected plant will get the virus. If it's a mature plant with fruit, the fruit will probably continue to ripen. If the plant is young, the fruit may be stunted and



ripen prematurely. The best thing to do with an infected plant is to get rid of it, especially if you have leafhoppers in your garden (as most of us do). You can also try to prevent the virus by preventing leafhoppers. Lacewings and ladybugs can be attracted by planting cosmos, coreopsis, and daisies; and damsel bugs can be attracted with lavender and thyme. All of these beneficial insects are the leafhopper's natural predators and can help keep them at bay.



*Curly top virus*



## CORN SMUT

If they were handing out an award for the most alien-looking plant disease, corn smut would easily take the prize. This fungal disease infects corn kernels, and balloons them up into huge grayish growths. It may not be something you would want to serve at your next backyard barbecue; however, corn smut is actually considered a delicacy in Mexico (where it is called *huitlacoche*) and by some top chefs around the world, where it is used as a filling for tacos, quesadillas, and other dishes. That being said, if you're growing corn for corn, you might not want the gray alien growth taking over your corn patch. As with other fungal diseases, prevention is the best approach. If you have had corn smut in your garden, make sure to practice crop rotation and don't grow corn in the same location for at least four years. Don't use synthetic fertilizers, which often can be high in nitrogen that promotes the growth of corn smut. Instead, use a balanced organic fertilizer. If you do have corn smut, carefully bag and remove the infected plants. You can also grow smut-resistant corn varieties like 'Ambrosia', 'Aztec', 'Cherokee', 'Comet', and 'Tendersweet'.



*Corn smut*

## **DAMPING OFF**

Damping off is a common and fatal disease that affects all kinds of seedlings, but it's most prevalent in cool, wet soil. It comes on fast—almost overnight—and strikes the stem at or just below the soil line. Seedlings can go from vibrant and healthy to lying over on the ground. The tips can still look green for a short time, but the stem will be pinched and black with the leaves following shortly after. There is no

saving seedlings once they have been hit, there is only prevention. To prevent damping off, keep the top of the soil in your seed trays dry. Once the seeds have germinated, they will put down a root for deeper moisture. Letting the top of the soil dry out will not keep water from the developing seedling. If you see algae growing on the soil, that is a bad sign. You can help keep the top of the soil dry by placing an oscillating fan set to low in the growing area. This will provide the added benefit of strengthening the plant stems as they move back and forth in the breeze.



*Damping off*

## **EARLY OR LATE BLIGHT**

Blight—the disease that led to the Irish Potato Famine—is a fungal disease that can be devastating to crops like tomatoes and potatoes. It spreads by spores that are carried on the wind from one location to the

next. When warm, humid weather arrives, the spores jump into action and start reproducing like crazy. The first signs are small brown patches on the leaves and stems of the plants. If removed, there is a small chance of saving the plant, but usually there are more spores lying in wait.

Once it has taken hold, there is no cure. For potatoes, you can cut off all foliage down to the soil level. Done quickly, this can save the tubers from being affected and rotting. For tomatoes, once blight hits, there's really nothing you can do except try to salvage whatever fruit is left on the plant before the disease spreads to the tomatoes themselves.

Prevention is once again the answer. A thick layer of mulch can create a physical barrier between the plant and the soil to help cover spores from the previous year. When it rains or when you water from above, the spores can splash from the soil onto the lower leaves of the plant, where they can take hold and spread. The mulch can help limit the splash-up exposure, as can watering from below, but you can't control the rain. If you live in a humid environment and are lucky enough to have a greenhouse, growing your tomatoes under cover can block out the wind which brings in the spores, as well as the rain which can help spread them to the plants. You can also grow early varieties of potatoes that will produce before the arrival of warm, humid weather. There are also some resistant varieties of potatoes, 'Elba' being one of the best. 'Juliet' and 'Legend' are two varieties of tomatoes that also are blight resistant.





*Late blight*

## **MOSAIC VIRUS**

There are several different types of mosaic virus that can affect a wide variety of garden crops. The most susceptible crops are beans, cauliflower, cucumbers, squash, and tomatoes. Leaves with mosaic viruses are mottled with green, yellow, and white spots, and bands that resemble a mosaic or stained glass window. It can be spread in three ways, depending on the type of virus. Aphids can spread it from plant to

plant. Companion planting with plants like alliums will repel aphids, and plants like dill, fennel, and daisies will attract aphid predators to keep the aphid transfer managed. Just touching the virus and then touching another plant can also transfer the disease, so if you touch an infected plant, be sure to wash your hands before touching an uninfected plant. Sometimes it's even seed-borne, meaning the virus is in the seed, and as the plant grows the disease will show itself on the leaves. For seed-borne prevention, make sure to purchase seeds from reputable suppliers, and never save seeds from a plant that has had the virus. There is no cure for plants that have it, and they will need to be carefully removed from the garden and discarded.



*Mosaic virus*

## **POWDERY MILDEW**

I'm not sure there is a garden out there that hasn't been affected by powdery mildew. I'm also not sure there is a plant out there that is completely resistant to it. Powdery mildew is a fungal disease that affects most, if not all crops. It is caused by spores that drift into your garden from somewhere else or from other plants in your garden. Powdery mildew thrives in warm, dry climates, though it uses moisture to spread, usually in the form of water on the leaves or thick growth that



isn't able to be dried by the sun. There are a few ways to stop powdery mildew in its tracks if it's caught early, but it's best if you can prevent it before it appears. Start by not watering leaves and making sure your plants are pruned enough to allow airflow through the plant so leaves can dry out. Also, prune any leaves that have the beginnings of powdery mildew. Do not let them lie on the ground, and do not compost them—just throw them in the trash. Plants that are growing in more shade than they can handle will be most susceptible to mildew, so always make sure full-sun crops have at least six to eight hours of direct sunlight every day. You can also help prevent it by planting varieties that are more resistant to powdery mildew. If you have varieties you love that aren't as resistant to powdery mildew, plant the resistant varieties as companion plant buffers around the varieties you love. By interplanting more resistant plants with less resistant plants, you will reduce the overall amount of mildew in your garden.

If you've done everything you can, but the powdery mildew still persists, there are a few organic control measures you can take that will target and kill the mildew spores, while not harming the ecosystem you are working so hard to nurture. Make a solution of 1 teaspoon of baking soda mixed into 1 quart (1 L) of water. Spray the plants very heavily, as the solution will only kill the spores it comes into direct contact with. You can also mix 4 parts milk to 6 parts water and then spray your plants thoroughly. One more option is to combine 10 tablespoons of 3 percent hydrogen peroxide with 1 gallon (4 L) of water. Again, spray the leaves well. With all of these solutions, always test spray a few leaves and wait 24 hours. If there are no negative side effects, you can spray all of your plants.





*Powdery mildew*

## **RUST**

Rust is a fungal disease that generally affects asparagus, beans, berries, corn, eggplant, okra, onions, peas, and sweet potatoes. It's easy to identify, as it looks just like, well, rust. Goldish-brown powdery blisters will appear on the leaves of the plants. In severe cases, the leaves will be misshapen and eventually fall off, possibly completely defoliating the entire crop. As with mildew, prevention is the key. Water your plants from below, and keep the leaves as dry as possible, prune the interior of the plants for airflow, and prune off and discard any leaves that show the beginnings of rust. Keep plants healthy by growing them in the right amount of sunlight, and with the right amount of water. You can also interplant rust-resistant varieties as a whole or at the very least interplant some rust-resistant varieties with some of your favorites that are not rust resistant. Proper spacing is another good way to keep rust from spreading plant to plant. If your garden is prone to rust, try to space plants a little farther away from each other than you would normally. If you already have the disease in your garden, you can use

any of the treatments for powdery mildew, as they are both caused and spread by fungal spores.



*Rust*

## **VERTICILLIUM WILT**

Verticillium wilt is another fungal disease that lives in the soil rather than on the leaves of plants. Cucumbers, eggplant, melons, pumpkins, peppers, potatoes, squash, and tomatoes are most affected by this disease. The disease starts with a sudden yellowing of the leaves on one side of the plant. The leaves then wilt and die. Once a plant has



verticillium wilt, it cannot be saved. You can keep watering and fertilizing, and it may continue to produce for a while longer, but once it dies, the plant should be removed and discarded. (Verticillium wilt should *not* be added to the compost heap!) And because it's soilborne, it can live in the soil for years, so you will want to plant crops that are not as affected by the disease or plant verticillium wilt-resistant varieties of the affected crops.



*Verticillium wilt*

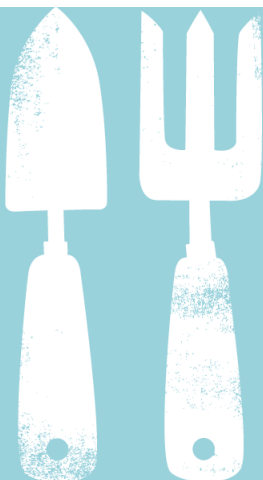
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## CHAPTER 7

### CALLING IN THE TROOPS (ATTRACTING BENEFICIAL INSECTS)

**ATTRACTING BENEFICIAL INSECTS TO YOUR GARDEN**

**THE OTHER GOOD GUYS—BIRDS, BATS, AND FROGS**

**COMPANION PLANTS FOR ATTRACTING BENEFICIAL INSECTS**

**BENEFICIAL GARDEN INSECTS**

**POLLINATORS—MORE THAN JUST HONEYBEES AND BUTTERFLIES**

**COMPANION PLANTS THAT ATTRACT POLLINATORS**

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## **ATTRACTING BENEFICIAL INSECTS TO YOUR GARDEN**

It was always the broccoli! Broccoli was always the first crop to get hit with aphids every spring. In my earlier gardening days, I would dutifully run to the garden and spray them off with the hose, and that would usually drown a good amount of them. But in a few days, their numbers would increase again. And then they would appear on the cauliflower ... and then on the cabbage. I always wondered how it happened so quickly. I thought a little neem-oil would knock them out, so I would bring out the sprayer, fill it with water, add the neem-oil, and off I'd go: spraying everything in sight. Because if the aphids could spread that quickly to the other brassicas, it was only a matter of time before they would get on everything else and then my garden would be infested. If I'd spot a few holes in the cabbage leaves (a sure sign of cabbage worm), I'd be back with the sprayer, this time filled with water and Bt! In my garden, it was a yearly occurrence—like clockwork. What I didn't realize was that those first sprayings of neem-oil and Bt had created a regimen of spraying that lasted all summer. It created a vicious cycle that never stopped.

Not long ago, I decided I wanted to try something different, so I added sweet alyssum, dill, and fennel to my beds at the same time I sowed my brassica seeds. To my dismay, there they were again: the aphids and cabbage worms. But this time, I held off and didn't take action. They were back in no time, but I continued to wait ... it was killing me. And then one morning, I saw a few ladybugs on the dill leaves and lots of hoverflies buzzing over the sweet alyssum. They were nowhere near the aphids, but they were there. Then a few days later, it happened: there were ladybug larvae and hoverfly larvae eating the aphids on my brassicas! I was literally watching them devour the pests right in front of me. Ladybug larvae can eat up to 250 aphids per day. And hoverfly larvae eat aphids, as well as cabbage worms. I still had to pick a few of the bigger worms off of the plants, but I never had to spray neem-oil or



Bt. It was in that moment that I was convinced that attracting predators to your garden through companion planting was the optimum way to tackle pest insects. When I was indiscriminately spraying these pesticides (even if I was being organic), I was accidentally killing the larvae of the insects that were there to help me. I'm not saying it was smooth sailing the rest of that year, but after a few seasons of building the ecosystem in my garden through companion planting, I no longer had to resort to sprays except on very rare occasions—and we're talking extreme situations, like almost-overnight spider mite infestations, and even then I would only spot treat very small areas.

It all begins with planting the right companions at the right times to attract the right predators to prey on the right pests and on the right plants. Does that sound complicated? It really isn't. First, let's tackle timing. A good rule of thumb is if you're sowing seeds, you should sow the seeds of your crop and the companion plants at the same time. If you're putting in transplants, both the crop and the companions need to be planted at the same time. This will get the companion plant blooming around the same time that pests usually show up. You should monitor your garden, though, to see if the pests show up before the companions are ready and blooming. If this happens, you should plan to plant your companions a week or two earlier the next year. Each garden will have different pests, and in varying climates, it's going to be a little different, so it's important to take good notes and make adjustments.



*Ladybug larvae on achillea*



*A mix of cucumbers, nasturtiums, squash, and marigolds*



## THE OTHER GOOD GUYS—BIRDS, BATS, AND FROGS

There's a significant number of beneficial insects that can help rid your garden of bad insects, but there's another group of good guys that can also help control pests in your garden—birds, bats, and frogs, and even snakes and lizards. Here are some things you can do to make your garden more friendly to these creatures and help attract them to your garden.



### BIRDS

Birds are considered a garden pest by some, but I happen to think they are one of your best allies. Sure, they might nip your tomatoes or peaches every once in a while. And they might pluck a few freshly planted peas in spring, but those things can be minimized by covering these irresistible goodies at the right time to protect them. The benefits of birds in the garden far outweigh the few negatives. I've sat in

amazement as warblers and wrens worked my brassicas over, eating up every cabbage worm in sight. Finches and sparrows happen to be fantastic unpaid weeders, stopping weed issues before they even start by devouring thousands of weed seeds before they germinate. (Try paying someone to sift through your garden soil and remove the weed seeds and see how much you will then appreciate these birds!) You can attract birds to your garden by planting trees, just not in an area where they will shade the vegetable garden. You can also plant a wide range of plants that will provide shelter for the birds and if they produce fruit or berries that we don't typically eat, even better. Plants like firethorn, winterberry, chokeberry, and hawthorn are great choices. Birdbaths and bird feeders are also wonderful ways to attract birds to the garden, and it's fun to watch the birds feed and play. Just make sure the feeders are squirrel-proof and that you place them far enough away from the garden that you don't lure squirrels and other rodents to your produce. Speaking of rodents, birds of prey, like owls, can help minimize these pests if you have them around. If you have a large property, you might consider building a barn owl box in hopes a family of owls will move in and patrol your garden every night from the air.





## BATS

Birds aren't the only winged gardeners. Consider the bat! When the insect-eating bird species clock out for the day, bats take over the night shift. I know many people are terrified of bats, but bats are not blood-thirsty attackers that spread rabies like the plague. Actually, bats are timid, gentle creatures that avoid human contact and have a much lower rate of rabies than most other animals that frequent your garden. In North America, almost all species of bats are exclusively insect eaters. In fact, they'll consume one-quarter to one-half their body weight in mosquitoes and moths every night. But they don't stop at mosquitoes and moths. Bat's diets can include any form of flying insect there is, and one bat can eat up to 8,000 insects each and every night. To attract bats, plant a variety of fragrant, night-blooming plants like evening primrose and flowering tobacco. Nocturnal insects will congregate near these

plants, and the mere existence of the insects will attract bats. You can also build bat houses and hang them high in a tree to give them a place to shelter and sleep during the day.

## **FROGS, SNAKES, AND LIZARDS**

Once you've attracted bats to your garden for nighttime air patrol, and you've added birdbaths to attract the daytime flight shift, you might want to take the plan to the next level and consider adding a small garden pond. This water source will provide homes for frogs and a gathering place for toads. Even a container pond will do. If you do add a pond, create moist shady places for these little helpers to seek shelter from the hot sun during the day. Marginal pond plants like reeds and sedge, water plants like water lilies, and shore plants with large shady leaves like hostas, will all make frogs feel at home.

Frogs can eat over 100 insects every single night. And you may not like it, but lizards and snakes have their place in your garden as well and perform important pest control duties. Lizards eat ants, aphids, grasshoppers, and other pests. And while they do occasionally chomp on leaves, the damage is minor and barely noticeable. Snakes take care of some insects and larger pests like slugs and snails, mice and rats, ground squirrels, and moles and gophers. As much as you may dislike the thought of these slithery creatures in your garden, as long as they are not venomous, it's best to leave them alone to patrol for the critters you'll dislike even more—the ones eating your crops.



## **COMPANION PLANTS FOR ATTRACTING BENEFICIAL INSECTS**

Here are some of the best companion plants for attracting beneficial insects to your garden.

### **ALYSSUM**

Alyssum or sweet alyssum is a low-growing annual that is easy to cultivate; it self-seeds, which means it returns year after year, without becoming invasive; it's heat and drought tolerant, though it looks its best with regular watering; and it comes in white, pink, purple, and yellow. Alyssum is a very shallow-rooted plant, so it won't compete with the crops it's planted around for water and nutrients. On top of all that, it's almost maintenance- and pest-free. Alyssum attracts a wide range of beneficial insects, including aphidius wasps, hoverflies, ladybugs, and parasitic wasps. Alyssum is a great companion planting choice for lower- to medium-height crops that have issues with aphids, such as broccoli, cabbage, cauliflower, lettuce, and peppers. You can sow the seeds in spring after all danger of frost has passed. Scatter the seeds on top of the soil in a full-sun location. Press them down so they make contact with the soil, but don't cover them—they need light to germinate. Keep them moist, and in just a few weeks, you will have a carpet of alyssum growing under the plants that it will help protect.





*Alyssum*

## **BASIL**

Basil is one of my favorite companion plants, especially for tomatoes. It's a summer annual herb that loves the sunshine. Its strong scent can confuse pests who might be looking for crops that they can eat or lay their eggs on—eggs that will produce larvae that will then eat your veggies. When you plant basil near crops that pests locate by smell, it literally will throw them off the scent. It also has flowers that honeybees go crazy for. The only bad thing about letting basil go to flower is that as soon as it does flower, the leaves will become bitter. I always grow red basil just for the bees, and green basil just for me. I let the red variety flower, and continue flowering throughout the season, but I pinch out the tips of the green basil before it gets a chance to produce flowers. (You can use those delicious basil tips in the kitchen.) Basil is very easy to grow from seed. You can start the seeds indoors and plant them in the garden after your last frost date. I line my tomato bed on the sunny side with alternating red and green basil.



*Basil*

## **CARROT**

Did you know that carrots produce beautiful flowers? The carrot family (Apiaceae) consists of many flowering plants that we already grow as edibles, including carrots, anise, celery, cilantro, dill, fennel, parsley, and parsnip, and even a few we would typically grow in a flower border, such as angelica and Queen Anne's lace. What they all have in common are tap roots, hollow stems, and flat, umbel-shaped blooms. It's these umbel-shaped blooms that make carrots, and most of the carrot family star performers for attracting beneficial insects such as hoverflies, lacewings, ladybugs, parasitic wasps, and tachinid flies. Every year, I let a few carrot, cilantro, dill, and parsley plants go to flower to bring in these "good" bugs. Don't let all of them flower, however; once a carrot flowers and starts to make seed, it uses the sugars in the carrot (the root) to do so, and the carrot will no longer be fit to eat. Carrots don't like being transplanted, so direct sow carrots into the garden three to five weeks before your last frost date. They prefer full sun but will tolerate



partial sun. Don't amend the soil with manure before planting, it will cause your carrots to fork and create all kinds of funky (and obscene) shapes. When growing carrots from seed, you need to have patience. They can take up to two weeks to germinate. They are also very sensitive to drying out—drying out even once can kill them. However, they also don't like to be covered with soil. They like being sown on the soil surface and then pressed down just enough to make contact with the soil. Therein lies the problem: it's very easy for the soil surface to dry out an hour after watering. So instead of watering them every hour, take a piece of wood the size of your carrot planting area and place it on top of the seeds. After about a week, begin checking the seeds daily, and when you see 50 percent germination, remove the wood. They will send their roots down deep enough to take in regular watering at this point.



*Carrot*

**COSMOS**

There are few flowers that put on as long a show in the vegetable garden as cosmos. If deadheaded, they can bloom all summer long. They are great companion plants, as their height ranges from 12 to 48 inches (31 to 122 cm), but the foliage is light and airy, and the plant as a whole doesn't crowd out its neighbors but instead mixes and mingles with any plant that is next to it. During their long bloom season, they will beautify the vegetable garden but also attract many beneficial insects such as damsel bugs, big-eyed bugs, hoverflies, lacewings, and parasitic wasps. Because of the wide array of beneficials cosmos can attract, they're a good choice for companion planting with almost any crop that doesn't grow taller than them. Cosmos thrive in full sun and, as such, will suffer when mixed with taller plants that will shade them, like corn and pole beans. However, when planted on the sunny side of the corn or beans, they will do just fine. I have cosmos growing all over my beds. Not necessarily because I planned it that way, but because cosmos are great self-seeders and do that job for me every year. To get your first season of cosmos started, scatter the seeds in the areas you wish them to grow once your last frost date has passed and then lightly rake the area over. Keep the seeds moist and they will germinate within seven to ten days. Once flowering, make sure to deadhead them regularly to extend the bloom season and life of the plants. They love light, rich soil that is kept consistently moist.





*Cosmos*

## **CRIMSON CLOVER**

This is one of those nonedible companion plants that serves so many purposes. It's my favorite cover crop and living mulch because it is beautiful, is easy to control, gives back to the soil, attracts beneficials, and provides shelter for pest predators like ground beetles, damsel bugs, and assassin bugs. Crimson clover is actually a legume and, as a living mulch, shares the nitrogen it fixes in its root system with adjacent nitrogen lovers like brassicas. It shades the ground, suppressing weeds, and keeps water evaporation from the soil to a minimum. The bees love the blooms; however, don't let the gorgeous flowers seduce you. When they are flowering but before they set seed, they must be mown or cut down to the soil level. You do not want them going to seed or they will become difficult to control. If you cut them down at this time, they will have the peak amount of nitrogen fixed in their roots and won't grow back. That's okay, though; they are fast growers, so you can just broadcast more seed to the same area. In addition to companion

planting them with nitrogen lovers like brassicas, crimson clover is a great choice to companion plant with taller crops that are damaged by caterpillars, such as corn and tomatoes. You can grow crimson clover very easily from seed, and there are a couple of different ways to plant it. Plant it as a winter cover crop in fall for winter protection, and you'll be prepping the bed for spring with all of the nitrogen it will leave in the soil. To do this, broadcast the seed six to eight weeks before your first frost and then lightly rake it over. It will grow and do its job all on its own, and if you get frosts and freezes, it will be killed instantly. If not, mow or cut it down in the bloom period but before it sets seed. Leave the cut plants right on the ground as a mulch for winter protection. You can also sow the seed in spring at the same time you are sowing the plants it will be a companion to. You can sow it again, once you've cut it down, in late spring or early summer.



*Crimson clover*

**DILL**

Dill is a tall, stately annual with feathery foliage and yellow umbel blooms. It's a useful and delicious herb in the kitchen but is just as useful and beautiful growing in the garden. It's one of those companions that gives your garden protection from pests but gives you a harvest as well. Dill is at its peak of attractiveness to beneficial insects when it is blooming, so definitely let it go to flower. It's a Mediterranean herb, so it can get by on little water and is a good companion plant for most crops. It's another plant that will attract aphid predators like hoverflies, ladybugs, and parasitic wasps. Dill is a great choice to companion plant with taller or partially shade-tolerant crops that are known to be attacked by aphids, such as beans, kale, lettuce, and tomatoes. You can sow dill seeds directly in the garden as soon as all danger of frost has passed. (They don't like being transplanted.) You can continue sowing seeds every few weeks throughout the season and into midsummer for a continuous supply. Dill likes well-draining soil and is a sun-loving plant that needs at least six to eight hours of direct sun. Thin the plants to give them about 10 to 12 inches (26 to 31 cm) of space between them.





*Dill*

**MARIGOLD**



When I ask someone what they know about companion planting, the answer always seems to have something to do with marigolds.

Marigolds have long been believed to repel certain pests (both insect and mammal), to help certain plants grow better, to give certain vegetables more flavor, and the list goes on and on. While there is little-to-no scientific evidence for many of these claims, marigolds do have many proven benefits that have evidence to back them up. Marigolds do repel root-knot nematodes; however, not as a companion plant but as a cover crop that is grown to maturity and then tilled into the soil a few weeks before food crops are planted. Hoverflies are highly attracted to the marigold's flowers, and assassin bugs use the bushy foliage for shelter. Marigolds do have a strong scent and can be planted as companions to confuse certain pests that use smell to locate their favorite food crops, such as carrot fly and hawk moth (tomato hornworm). So while they may not quite live up to the hype that has been created about them for decades, they are still a useful and easy-to-grow companion plant in the vegetable garden. Marigolds thrive in full sun and will tolerate a variety of soil types and conditions. Space plants or seeds 8 to 12 inches (20 to 31 cm) apart and make sure to deadhead them throughout the season to keep them looking good right up until first frost.



*Marigold*

## **LAVENDER**

Lavender is one of my favorite herbs to grow because it's so versatile—it can be used for scent, health, and cooking, and it also attracts numerous beneficial insects to your garden. The bushy plants provide cover for big-eyed bugs, assassin bugs, and ground beetles, and the flowers are magnets for butterflies, ladybugs, damsel bugs, and hoverflies. Lavender is easy to grow if you know what it likes. It comes from the

Mediterranean region, so just imagine a Tuscan hillside: baking sun, dry soil, and very few nutrients. I think more lavender is killed from over care than neglect. Drainage is key for lavender. If you have sandy soil, you're good to go! If you have loam, you could add some horticultural grit to the planting hole to improve the drainage. If you have heavy clay soil, lots of grit will be needed, and you might have to consider growing lavender in containers. Most lavenders are winter hardy in zones five through nine. Spanish lavender is a little more finicky and is only hardy in zones seven through nine. Lavender isn't the easiest to grow from seed, as it can take more than a month for germination. The best way to plant lavender is from small nursery transplants.





*Lavender*

## **POPPIES**

I grew poppies for the first time a couple of years ago, and that's all it took. My spring garden will never be without them. I have never seen honeybees fight over flowers like I do with poppies. Each poppy has often contained three or four bees at a time. And this comes at a time of year where nectar- and pollen-rich flowers are few and far between, so it's understandable why bees would become possessive. I've seen



honeybees, bumblebees, and native bees all jockeying for prime position in these beautiful, delicate flowers. I'm not sure it even matters what type of poppy you, grow just as long as it is a single and not a double. Single flowers contain an open center, with pollen-covered stamens in full view that are surrounded by a single circle of petals. Double flowers look more like double peonies with no stamens showing. With double flowers, the pollen is hidden by a mass of petals. Poppies are really easy to grow from seed, but they don't love being transplanted. Direct sow the seeds in full sun about 12 inches (31 cm) apart. They are very tolerant of different soil conditions but need adequate moisture to yield a full, robust plant. Deadhead them regularly throughout the growing season to keep them producing more and more blooms. Poppies are all about the bees, so make sure to plant your poppies where the bees are most needed for pollination, such as around squashes, melons, potatoes, all types of berries, and fruit trees.



*Oriental poppies*

## THYME

Thyme is another herb that is great to the cook with in the kitchen but it is also a great companion to your garden crops. Thyme is a low-growing, woody, perennial Mediterranean herb that attracts parasitic wasps, big-eyed bugs, damsel bugs, ground beetles, and ladybugs. Many of these beneficials will handle a whole host of pests in the garden, from caterpillars to aphids and from mites to whiteflies. Because it is low growing and sun loving, always plant it with low-growing plants like strawberries, bush beans, and lettuce, or on the sunny side of taller crops. Thyme likes a well-draining soil that dries out between watering, so if you grow it in raised beds, plant it right on the edge. If you grow it in rows, plant it between rows where it will get less water than the rest of your crops. If neither of these are possible, you can also plant thyme in pots, and place the pots throughout the garden. Thyme can be started from seed if you have lots of patience. (I like to buy transplants.) The seeds can take up to 12 weeks to germinate. Thyme is perennial to zone five, so in many zones it is a great investment that will pay dividends for years to come. Because thyme is perennial, it can be dug up every couple of years and divided into multiple plants that you can then spread around the garden.



*Thyme*

## **YARROW**

Yarrow is a perennial that can make itself very useful when planted among your vegetables. It has fernlike foliage that is about 12 inches (31 cm) tall and produces flower stalks that can be 12 to 36 inches (31 to 92 cm) tall, and it comes in many colors including yellow, white, and pink. It has been used by humans for thousands of years to help stop bleeding and heal wounds, but it also confuses and repels pests with its strong odor. In spite of the smell, beneficial insects flock to the flowers which contain hundreds of tiny nectar sites. Bees, butterflies, parasitic wasps, lacewings, hoverflies, big-eyed bugs, and ladybugs all find yarrow irresistible. I plant yellow yarrow with many vegetables, but I get particularly good results planting it with squash and melons. The fact that it attracts pollinators, especially bees, to a plant that definitely needs help with pollination is one reason. A second reason is that the yellow flowers of the yarrow are almost identical in color to most squash blooms. Squash blossoms, especially bush types, can hold their blooms



under the leaves, and when there are few pollinators around, the blooms are not on display to attract them. Yarrow holds its blooms high and proud and can serve as a beacon to draw the pollinators nearer the squash plants where they have a better chance of seeing the partially hidden squash blooms. The beneficial insects it attracts will help take care of some of the most common squash pests, like squash bugs and vine borer larvae. Yarrow can be grown from seed, but it's easier and faster to buy plants from a reputable nursery. Again, it is a perennial, so this is a good investment that will pay you back with more and more plants every year. You can divide the roots every year or two, and then spread the plants around your garden. Plant yarrow in full sun with well-draining soil. It can thrive in many types of soil, but will do best in the same type of soil as most of your vegetables.



*Yarrow*



## **BENEFICIAL GARDEN INSECTS**

In this section, I include some of the most common beneficial insects that will help you as a gardener rely less on organic insecticides. I will also give you companion planting strategies you can use to attract more of them to your garden. Each of these “good” bugs prey upon a wide variety of pests and having many of these varieties in your garden will make your job easier. Keep in mind that some of these predator bugs will kill and eat beneficial insects as well, but if you have a mixed planting, you will have a balanced ecosystem where they can all thrive.

### **ASSASSIN BUG**

There are hundreds of species of assassin bugs, and they range in length from ¼ inch (7 mm) to 1 ½ inches (38 mm). They have short three-segmented beaks that they use to first pierce the body of prey; the beak is then used like a straw to suck out the body fluids. Most assassin bugs come in different shades of brown and tan; however, some species are brightly colored. Most species have long, thin legs. They eat a wide variety of prey including aphids, cabbage worms, small beetles, tomato hornworms, and other caterpillars. Because they also prey on other beneficial bugs, you'll want to attract them to your garden but not purchase and release hundreds of them. To attract them to your garden, have a variety of bushy plants. They're not picky nor do they have one specific plant that brings them in.



*Assassin bug*

## **DAMSEL BUG**

Damsel bugs look very much like assassin bugs. The difference is that the head of a damsel bug is cone-shaped, and the head of an assassin bug looks more like a turtle with a longer neck and a bulbous head. The beaks of assassin bugs are also thicker than the beaks of damsel bugs. While they feed the same way as assassin bugs, their prey is usually more on the small side and will include aphids, mites, small caterpillars, and other small insects. While they do prey upon other beneficials, they are also the prey of other beneficials. (Again, it's about balance.) To attract damsel bugs to your garden, provide them shelter and hunting grounds. They typically hunt close to the ground, so short bush plants

like bush beans, oregano, and thyme are good shelter options for damsel bugs.



*Damsel bug*

## **GROUND BEETLE**

There are about 40,000 species of ground beetles throughout the world, and their lengths range from about 1/8 inch (3 mm) to 1½ inches (38 mm). They are typically black to brown in color and have small ridges running the length of their bodies. They have telltale mandibles, which they use to catch and eat their prey. Ground beetles feed on a wide range of pests including aphids, moth larvae, beetle larvae, and mites. They usually hunt and feed along the ground, and rarely venture up into a plant. They hunt at night and seek shelter during the day under



rocks, pieces of wood, fallen leaves, and mulch. Providing these shelters and not any particular plants will attract them to your garden and encourage them to stick around.



*Ground beetle*

## **HOVERFLY**

There are thousands of species of hoverflies, and most are between  $\frac{1}{4}$  inch (7 mm) and  $\frac{1}{2}$  inch (13 mm) long. They look like miniature wasps but have the head of a fly and are harmless to humans. Not only will hoverflies not hurt you, but also will be one of your most helpful garden allies. They are terrific pollinators, and their larvae are voracious predators, feeding upon soft-bodied pests like mites, thrips, and even small caterpillars. The adults feed on pollen, nectar, and also the honeydew from aphids. Each female can lay up to 100 eggs in her lifetime but only if there are sufficient pollen and nectar sources available. You can attract adult hoverflies to your garden by providing



flowers with abundant nectar and pollen such as dill, fennel, sweet alyssum, and cosmos.



*Hoverfly*

## **LACEWING**

Lacewings are light green and about  $\frac{1}{2}$  (13 mm) to  $\frac{3}{4}$  inches (2 cm) in length, with long, thin antennae. They have yellow eyes and long, finely veined wings. Adult lacewings feed mainly on nectar and pollen, but it's their larvae that control pests in your garden. They control aphids so well that they're also known as "aphid lions." They inject the aphids with a paralyzing venom and kill them by sucking out their bodily fluids. Aphids aren't the only pest they control. Lacewing larvae also hunt and eat mealybugs, spider mites, moth eggs, scales, thrips, and whiteflies.

Lacewings may be the best natural pest control insects we have and can be attracted by companion planting with dill, yarrow, tansy, cosmos, and

daisies.



*Lacewing*

## **LADYBUG (LADYBIRD)**

Ladybugs (or *ladybirds*, as they are known in some areas) are probably the most well-known beneficial insect. There are over 6,000 species of ladybugs all over the world. They are mostly red, orange, and yellow, with a variety of black spot patterns on their wing covers. Most are about ¼ inch (6.5 mm) long. They live from three to six weeks and in that short time, will lay up to 1,000 eggs. When those eggs hatch, the larvae immediately start eating. Over the course of the next few weeks, the average ladybug may eat up to 5,000 aphids. And they don't stop at aphids. Ladybugs eat many other garden pests including beetle larvae, mealybugs, spider mites, and whiteflies. It might be tempting to purchase ladybugs at garden centers to release into your garden, but don't do it. Almost all ladybug beetles sold in the United States are wild harvested, which means you'll have no idea where they came from. Up to 15 percent of these harvested ladybugs can carry parasites and

diseases that will infect ladybugs native to your area. What's more, you typically won't be able to keep store-bought ladybugs confined to your garden unless you make some sort of enclosure with fleece or floating row covers, and even then there is no guarantee they will feed on the pest insects because they likely were harvested while hibernating. Instead, you should attract ladybugs to your garden by companion planting chives, cilantro, fennel, thyme, and yarrow.



*Ladybug*

## **PARASITIC WASP**

Why would you ever want to attract wasps to your garden? This particular wasp is very tiny,  $\frac{1}{16}$  inch (1.5 mm) to  $\frac{1}{2}$  inch (13 mm) long, and harmless to humans. However, they are anything but harmless to a whole host of garden pests. Parasitic wasps lay their eggs under the skin of their prey, and when the eggs hatch, the larvae consume their hosts from the inside out. Parasitic wasps can help manage aphids, scales, whiteflies, sawfly larvae, leaf miners, and many species of caterpillars, including tomato hornworm. The babies are the carnivores, but the



adult parasitic wasps need a continuous supply of pollen and nectar. Companion planting with cilantro, dill, sweet alyssum, daisies, and asters will lure them in, keep them around, and encourage them to produce their “killer” babies.



*Parasitic wasp*

## **PRAYING MANTIS**

There are about 1,800 species of praying mantises around the world. Most range in length from ½ inch to 7 inches (13 mm to 15 cm), and are light green or brown in color. To attract praying mantises to your garden, companion plant with cosmos and marigolds. They also like to shelter under large-leaved plants like squash. You can purchase egg cases to place in your garden, but you want to be careful: praying mantises are beneficial insects and they also eat beneficial insects. You don't want to



bring them in by the thousands and tip the balance in your garden ecosystem in the wrong direction.



*Praying mantis*

## **SPIDER**

Technically not insects but arachnids, there are more than 45,000 known species of spiders throughout the world. It would be hard to find anyone who needs a description, but most spiders are completely harmless to humans. In fact, in the United States, there are only four venomous spider species that can harm humans: black widow, brown recluse, yellow sac, and hobo. All spiders are carnivorous predators and should be welcomed in your garden. They help manage almost all garden pests (and a few beneficials). You can attract spiders to your

garden by providing a varied planting of companions that provide different heights and textures for spiders to seek shelter in.



*Wolf spider*

## **POLLINATORS—MORE THAN JUST HONEYBEES AND BUTTERFLIES**

Honeybees and butterflies might get the most attention when gardeners talk about garden pollinators, but there are numerous other species that will help pollinate the plants in your garden.

### **BEEES**

It might seem difficult to imagine how nature ever got along before the honeybee came across the pond, but only if you didn't know about the thousands of other bee species that don't live as groups in hives and don't make honey. There are numerous other species that are just as important as honeybees, but they don't get the same amount of attention. Believe it or not, there are approximately 4,000 native bee species in North America and over 20,000 species around the world!





*Honeybee visiting lavender*

### **European Honeybee**

Out of the over 20,000 bee species on Earth, there is only one species—the European honeybee—that lives as a group in hives and is managed commercially. And it's for good reason: they are the most well-known



and effective pollinators on the planet. Honeybees were imported to the United States from Europe in the seventeenth century. And in addition to making honey, which is a by-product of pollination, honeybees are built for pollination. It's believed honeybees are responsible for pollinating roughly one third of our total food supply. There is hardly a crop you can think of that isn't pollinated by these diligent workers.



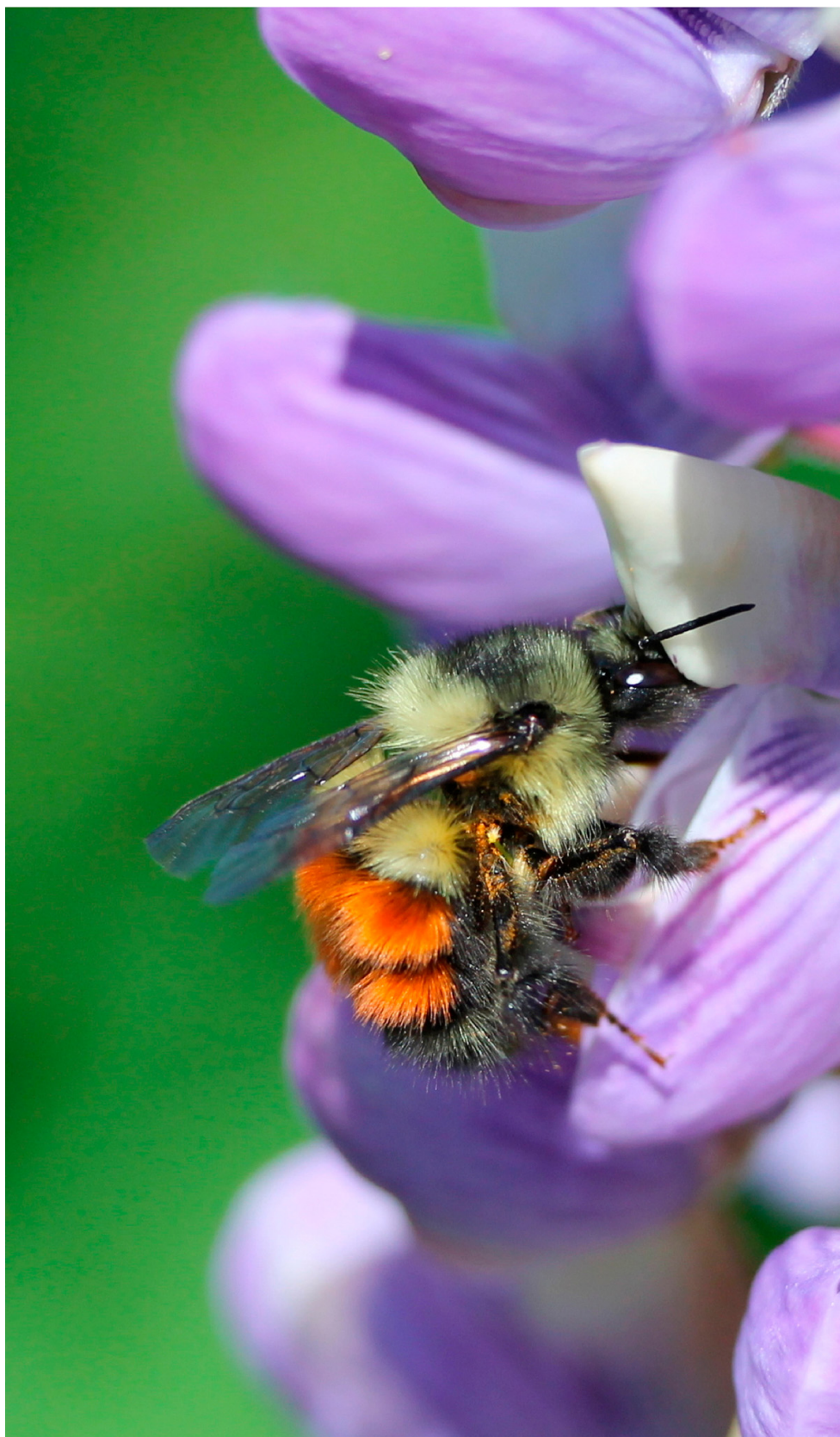
*Honeybees collecting pollen on an onion flower*

### **Bumblebees**

Bumblebees beat their wings over 130 times per second. They pollinate by *buzz pollination*, which means they cause pollen to shake loose from a flower's anthers and land on the stigma to pollinate the flower via the

beating of their wings. Bumblebees are great pollinators of plants that have perfect flowers, meaning the male and female reproductive parts are both contained in the same flower. Some plant species with perfect flowers include tomatoes, peppers, eggplant, and berries. In addition to growing these crops in your garden, you can grow other flowers to attract bumblebees. Lavender, bee balm, and basil are all excellent choices to invite bumblebees in to pollinate your garden.





*Bumblebee*



**Leaf-Cutting Bees, Mason Bees, and Sweat Bees**

Included in the over 4,000 native bee species in North America are leaf-cutting bees, mason bees, and sweat bees. These small, docile species are a little more specialized than honeybees in the types of crops they pollinate, but they are very effective at getting the job done. Female leaf-cutting bees, in particular, are very good pollinators, as they have hairy bellies that enable them to easily collect and transfer pollen as they move from flower to flower. Leaf-cutting bees cut small pieces out of plant leaves that they use to line their nests and wrap their larvae in. If you see semicircular portions of leaves missing, it's likely the work of a leaf-cutting bee. They won't harm your plants by cutting the leaves and they will pay the plants back by pollinating them.



*Native bee*



They are attracted by and will pollinate a wide range of flowers, including peas, beans, melons, sunflowers, mint, onions, borage, and more.

Mason bees and sweat bees have metallic green bodies, and are good overall pollinators, but they specialize in pollinating fruit trees such as peach, plum, nectarine, pear, and loquat. Sweat bees tunnel into bare, sunny soil where they will nest and raise the next generation, while mason bees will nest in holes they find in wood or in the hollow stems of plants.



*Native bee species visiting echinacea*

## HOVERFLIES

Also known as *syrphid fly* or *flower fly*, there are over 6,000 species of the hoverfly. In addition to being pollinators, hoverflies are great for pest control. While the adult hoverfly's diet consists of nectar and pollen, the larvae will feed on a number of pest insects. As a species, they are not as

effective as pollinators as they are at controlling pests, but they are pollinators nonetheless and are great to have around since they serve this dual purpose in the garden. Hoverflies look like small, skinny bees that literally hover very still in midair near flowers like sweet alyssum, dill, fennel, cosmos, and zinnia. You can attract them to your garden by planting those very flowers. Although they carry less pollen on their bodies than other bees, they compensate for that shortfall by making a greater number of flower visits.





*Hoverfly*

## **BUTTERFLIES**

Butterflies get a good amount of attention as pollinators, but because of their long skinny legs and tongues, much of their body stays suspended over flowers and never actually touches the pollen. They also don't have



any specialized body parts to collect pollen. While they are beautiful and will pollinate to some extent, they are more decorative than functional. You can attract monarch butterflies to your garden by planting the one plant that their larvae eat: milkweed. You can attract swallowtails by growing dill and fennel.



*Monarch butterfly*

## **MOTHS**

The less colorful, nocturnal relative of the butterfly is the moth, and it does a much better job of pollinating flowers than the butterfly. Moths take over the night shift while the bees are sleeping. Moths are generally hairy, unlike butterflies, so they can pick up much more pollen and move it about the garden. You can attract moths to your garden by growing night-scented flowers like evening primrose and flowering tobacco. There are over 11,000 species of moths in the United States alone. While some species do come out during the day, most are nocturnal.



*Moth making a daytime visit to a flower*



## **COMPANION PLANTS THAT ATTRACT POLLINATORS**

Attracting pollinators to your garden isn't just about deciding which plant to situate next to the other; it's about creating a tapestry of blooms throughout the garden that will act as homing beacons for any pollinators who might be flying or fluttering by.

## **GOOD PLANTS FOR POLLINATORS**

Here are some flowering plants that won't act as resource thieves in a vegetable garden. They will play nice with others, won't disrupt the harmony of your companion planting relationships, and most importantly, will be great for attracting pollinators.



*Umbel flowers like dill attract pollinators*

## **UMBEL FLOWERS**

I've mentioned "umbel flowers" many times. The term *umbel* refers to an inflorescence that is made up of many short flower stalks that spread from a common point, much like an umbrella (though they remind me more of fireworks). The term *umbrella* was coined from the Latin word for parasol, which is *umbella*. If allowed to flower, many vegetable crops we grow in our gardens would produce umbel flowers: carrots, cilantro, parsley, dill, and fennel, to name a few, and I always allow a few of these plants to go to flower before I pull them up.

Other, more ornamental flowers that fall under the umbel category include Queen Anne's lace, astrantia, angelica, and cow parsley. You'll be amazed at how many beneficial insects show up when you plant umbels. Beneficial insects that are most attracted to umbel-shaped flowers include parasitic wasps, hoverflies, ladybugs, and tachinid flies.





*Zinnia*

## **DAISY-TYPE FLOWERS**

Daisy-type flowers are another popular choice for attracting pollinators. Daisy-type flowers are members of the Asteraceae family, which includes over 32,000 different species. When you look at the flower of a species, like a Shasta daisy, you might think you are looking at just one flower, but in fact you are looking at hundreds of yellow florets contained within a circle of white bracts or what look like petals. Each of those florets contains nectar, and the entire inflorescence (meaning the complete flower head) is made to not only attract pollinators, but to



give them a comfy place to sit, relax, and have a drink. Beneficial insects most attracted to daisy-type flowers include bees, hoverflies, and lacewings. As Asteraceae is a family that covers so many species, there are quite a few that will work well as companions in the garden. Good choices include echinacea, daisies, sunflower, calendula, cosmos, marigolds, and zinnias.

## **BRASSICAS**

The Brassicaceae, or mustard family, includes crops such as broccoli, cauliflower, radish, and mustard. You can let some of these go to flower, and they will attract a wide range of pollinators. You can also companion plant with ornamental flowers from the brassica family, which includes alyssum, sweet rocket, nasturtiums, candytuft, and wallflowers. Brassica flowers are huge attractors of honeybees, solitary bees, and hoverflies.



*Nasturtium*

## LEGUMES

Another family of plants that covers the edible and ornamental range is the legume family. The most common legumes are the beans and the peas we grow as edibles. This includes pole (runner) beans, bush beans, snap peas, shelling peas, fava beans, and even peanuts. Legumes grown as ornamentals include wisteria, lupines, and sweet peas, but I don't recommend planting any of these in the vegetable garden because of their size. In the case of sweet peas, they could be confused with edible peas. (Sweet peas are poisonous.) Most of the legumes we grow in the vegetable garden that are not edibles are grown as cover crops or living mulch. Crimson clover, red clover, white clover, and hairy vetch are all

examples of these, and all are highly attractive to pollinators, especially bees.





*Runner beans*



## Planting Flower Borders

Many flowers are very efficient at attracting pollinators but are too large for companion planting in the vegetable garden. Perennials like buddleia and rudbeckia are wonderful plants that pollinators love, but due to their size and growth habits, they are best planted in a perennial border adjacent to the vegetable garden where they won't compete for space and sunlight with your vegetables. Having flower borders near your vegetables is an invaluable tool for attracting more beneficial insects than you could ever attract with vegetables alone, so I highly recommend using them.



## ATTRACTING SPECIFIC POLLINATORS

While there are many types of pollinators in the garden, not all of them have the ability or desire to pollinate every type of plant you grow. Here are three popular crops that need specific pollinators to perform the job.

### SQUASH AND MELONS

Squash, melons, and any other member of the cucurbit family are pollinated primarily by bees. But while honeybees can get the job done, there is a specific type of bee that only visits cucurbits, and that bee is fittingly called the *squash bee*.



*Squash bee resting inside a squash bloom*

Squash bees are native to the United States and were pollinating squash and gourds long before honeybees ever arrived from Europe. Squash bees are actually similar in size to honeybees and look like honeybees,

but they pollinate cucurbit blossoms exclusively, which means to attract them, you'll want to grow as many squash and melons in the same area as possible. Melons, however, can take up a lot of space, so if possible, you should grow them vertically on a trellis. Male squash bees spend the first few hours of the day jumping from flower to flower, looking for a mate. But all that speed dating is tiring, and in the afternoon, you are more likely to find the male squash bee fast asleep inside a wilted, closed-up squash blossom. During their prelunch courting, they do pollinate, but the female really does the heavy lifting in the pollination department, and also in the home-building department. Females dig ground nests in which to lay their eggs and store their pollen. Because squash bees nest in the ground, practicing no-dig will keep you from accidentally plowing through their nesting sites. Also, unless you have severe disease issues with your squash, you should grow them in the same area or close to the same area year to year.

## **FRUIT TREES**

If you have fruit trees in your garden, you will need the help of honeybees and other native bee species to do the pollination. Fruit trees bloom early in the growing season. And to attract the most bees during that time, you'll need to have flowers that bloom at the same time as the fruit trees. Crocus is a great choice to plant and naturalize between your fruit trees. Bees love crocus flowers, as they are chock-full of pollen and nectar. They also happen to be an early bloomer, and because of the way they can naturalize, they can make a beautiful carpet of flowers underneath flowering fruit trees. Once the fruit trees leaf out, they'll shade the crocus which, by the time the trees leaf out, will be finished blooming. Having flowers in your garden early in the year also helps our honeybee population, whose stores of honey will be dwindling after the long winter.



*Crocus*

**TOMATOES, PEPPERS, AND EGGPLANT**



Nightshades like tomatoes, peppers, and eggplant contain perfect flowers, which means each blossom contains both the male and female reproductive parts. These flowers can be pollinated by honeybees and native bees, but the best bees to get the job done are bumblebees. Because tomato flowers have both the anthers (the pollen-creating male part) and the stigma (the pollen-creating female part), pollen doesn't have to be brought from a male flower to a female flower, which honeybees are great at doing. These flowers simply have to be shaken or vibrated to jostle that pollen loose from the anthers and transfer it to the stigma. Female bumblebees latch themselves on to the flower's reproductive parts and vibrate their wing muscles to shake the pollen loose. In so doing, the pollen attaches to the stigma and pollination occurs. You can attract more bumblebees to your nightshades by companion planting nectar-rich flowers near your tomatoes. In the spring, you can't beat poppies. You can sow poppy seeds in fall or early spring, and they will reward you and the bees with an amazing floral display. For summer growing, you can grow bee balm and basil with your tomatoes to attract bumblebees (and all bees, for that matter) from far and wide.



*Tomato blossoms*

## **Supporting All Types of Bees**

It's incredibly important to support your local native bee population. There are many species of bees that were here long before the honeybee arrived on American soil from Europe, including leaf-cutting bees, carpenter bees, and more than 4,000 other types of native bees that the United States is home to. Providing these solitary, docile bees food and shelter in your garden is easy, and only serves to beautify your garden. It also helps create the diverse ecosystem these species need to thrive. Adding lots of flowering plants in and around your garden will help attract them and give them shelter.

## **PROVIDING HOMES AND HABITATS FOR POLLINATORS**

In previous chapters, we've talked about how to attract beneficial insects to your garden by offering their favorite foods and creating habitats and shelters so they'll stick around. The same is true for pollinators. Here are a few ways you can create habitats and shelters for those crucial pollinators.





## **CREATING NATURAL SHELTERS**

Pollinators will be attracted to your garden by the flowers on your vegetables and fruits. However, in order to keep them around, you will need to provide more flowers than what your harvestable plantings

can provide. It's important to companion plant a wide variety of ornamental flowers that will offer more blooms over a longer period of time. These flowers can be planted and grown in the vegetable beds, among your edible crops, or in an adjacent flower garden. In addition to food, pollinators also need a place to stay and create the next generation. For some, like hoverflies, it can be as simple as assembling a small pile of logs or branches to give them lots of nooks and crannies to shelter in.

Native bees are some of the best pollinators you can have in your garden. Lots of flowers will help get them there, but knowing what they like for shelter, and providing it for them, will get them to set up residence and reproduce. In fact, many of the baby bees will spend the winter in a nest their mother prepared for them, and if the digs are comfortable and there is plenty of food, they could even use the same nest to rear their own young. Different types of native solitary bees make and use different types of nests. Leaf-cutting and mason bees like to make their nests in the hollow stems of plants or in holes in wood. Sweat bees will tunnel into bare earth to make their nests. And bumblebees, well, the males will die off, but the females will spend the winter in shallow tunnels or holes in the ground. To create a natural shelter for these garden friends, grow plants that have hollow stems such as cane berries, bamboo, ornamental grasses, and dill. Let these stems dry out and don't pull them up. The bees will use them to overwinter and take shelter in, as well for nesting. For sweat bees and bumblebees, leave some bare earth without mulch, and make a note to never dig in that area. Doing so could mean you'll be destroying hundreds of bee tunnels. Providing a "safe space" for them means they'll have a place to thrive, and future generations of the species will also have a place to thrive.

## **MAKING A BEE HOTEL**

Of the 4,000 native bee species in the United States, about one-third of them will nest in hollow stems or grass. If you don't like the look of dead plants residing in your garden all winter, you can also make a bee

hotel. There are many designs, and there is no right or wrong type, but here are a few simple design ideas that will work:

- For one of the simplest bee hotels, use a block of wood that is about 6 inches (15 cm) deep and drill multiple holes of varying sizes into one end of the block that are about 5 1/2 inches (14 cm) deep. Attach a hook and a string to the top of the block and simply hang it from a branch.
- Fill a tin can completely full with hollow stems and reeds of varying sizes. Tie some string around the can so you can hang it from a branch.
- If you are a novice wood worker, you can get a little more creative with your hotel. Build a basic frame with two sides, a bottom, and a top. It will also need to have a back to prevent light from showing through the backs of the tubes. Fill it with hollow stems and reeds, and then attach a hook and string to the top so you can hang it from a branch.





There are a few things to know to ensure bees will like your hotel enough to rate it five stars, stay again, and refer it to their friends:

- Vary the hole and tube sizes from 1/8 to 1/2 inch (3 to 13 mm) to attract and house a wide variety of solitary bees.
- The holes or tubes should be about 6 inches (15 cm) deep.
- There should be a closed back to the tubes or holes, as bees don't want to see light at the ends.
- Houses should be hung on a post with a southern exposure and preferably in morning sun.
- Watch for predators like ants, which can infest the hotel and kill the bee larvae.



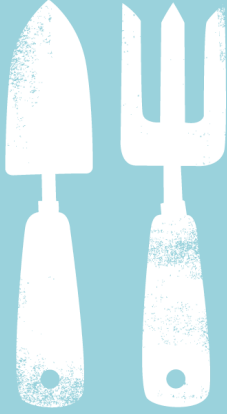


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## CHAPTER 8

# WEED MANAGEMENT



**BASIC ORGANIC WEED CONTROL**

**USING MULCH TO CONTROL WEEDS**

**COMPANION PLANTING FOR WEED MANAGEMENT**

## **BASIC ORGANIC WEED CONTROL**

Along with pests and diseases, weeds comprise the terrible trinity that frustrates gardeners the most (to say the least). The secret to effective weed control in your garden is preventing them from taking hold in the first place. Here are some tips for keeping weeds out of your vegetable garden.

### **WHAT IS A WEED?**

Technically, a weed is any plant that is growing where you don't want it to grow. In my garden, I have macadamia trees coming up all over the place every spring because the squirrels "plant" the nuts for me every fall. In your garden, you might have a pine tree seedling or a palm tree seedling that you consider a weed. On the other hand, something we might consider a weed, such as a dandelion, might actually be considered free food by others! There are two main types of weeds that we need to address because they grow in different ways and, for that reason, need to be managed differently. Annual weeds are the easiest to control and, fortunately, the most common. They include grasses like crabgrass and bluegrass, buttonweed, and lamb's quarters, and they all grow from seed that was dropped at some point. On the other hand, weeds like Kikuyu grass, oxalis, dichondra, ivy, and dandelions are perennial, meaning they mostly grow from roots that were in the ground already or from seedlings that took hold the previous year, weren't pulled, and then developed a root system that could last for years.



*A tangle of annual and perennial weeds*

## **ORGANIC WEED CONTROL METHODS**

One option for controlling weeds is using organic herbicides that are vinegar (acid) based. I have yet to find one that is powerful enough to really kill adult weeds, but there are some that will kill weed seedlings, or at least slow their growth. The best method for safely controlling weeds in the garden is hand pulling—and for good reason—because it works. I actually find hand weeding therapeutic. I put some music on, get to work, and before I know it, I've cleared an entire bed. (Hopefully you'll find this work as satisfying as I do.) Annual weeds have fairly shallow roots and are pretty easy to pull in moist soil. If the soil bed is dry, soak the soil the day before you are going to do the weeding, and the next day it will be much easier to pull the weeds out of the ground. (Just make sure you pull them out before they have set seed.) If you see flower heads emerging on the plants, you won't have much time to pull them before they begin to drop seed, so you'll want to address them quickly. If you pull them before they flower, you will likely stop the life cycle of the weed.

Perennial weeds need to be pulled very carefully because any piece of root that you leave in the ground will eventually grow a new plant, so it's best to use a weeding tool or a long trowel to remove them. To do so, dig down alongside the root, loosen the soil, and then pull the entire plant up and out. If you just pull off the top, the weed will regrow. And if you cut the root in half but don't remove either piece, you could end up with two plants. (Don't you wish your vegetable crops were this easy to grow?)





*Dandelion*

## The Wrong Way to Deal with Weeds



For decades, the easiest and, dare I say, most popular way of dealing with weeds was to use a synthetic herbicide like Roundup®. (My former, nonorganic gardening self was guilty of its use.) While it may seem like a quick-fix solution, in the long run, it will only make things worse in your garden. Is it not only bad for the environment, but also really bad for people.

In a recent study, researchers at the University of Washington used available data and concluded that Roundup® could increase the risk of people developing non-Hodgkin's lymphoma by up to 41 percent. One of the reasons I garden is for the health benefits, and this certainly doesn't fit into my idea of healthy gardening. Aside from the potential health hazards to the gardener, synthetic herbicides create hazards for your garden and the life it supports. Herbicides move through a plant to its roots to kill the plant, but it doesn't stop there. As the roots decay, the poison is passed to the soil where beneficial microbes and fungi live. According to research done by USDA microbiologist Robert Kremer, these poisons which are meant to kill plants are also toxic to these crucial components of our soil. The biggest impact was on an important bacterium that fixes nitrogen called rhizobia. The research and lawsuits continue, and maybe someday soon we'll fully grasp the dangers of these chemicals and their widespread use will finally diminish. In the meantime, as home gardeners, there are safer methods we can employ to control weeds. They may be not quite as easy as a synthetic spray, but they can be just as effective.

## **USING MULCH TO CONTROL WEEDS**

Mulch is anything that is spread over the top of soil as a covering. It can be made from just about any material that is organic and can be comprised of living, dead, or partially composted material.





*In my garden, my choice of living mulch for my tomatoes is basil.*



## TRADITIONAL MULCH

Traditional mulch is a great tool for suppressing weeds. A 2-inch to 3-inch (5 cm to 8 cm) layer of just about anything will keep sunlight from weed seeds, lessening their chances of germinating. When any kind of seed is planted too deep, it either won't germinate because of the lack of warmth and sunlight, or it will germinate but use up all of its energy trying to make it to the surface to receive energy from the sun. Adding mulch will help create this extra layer that will make it more difficult for weed seeds to germinate and reach the surface where they can receive sunlight. Mulch will also cover weed seeds that are lying on the soil surface, making it more difficult for them to germinate. (This is another advantage of no-dig gardening. When you turn over the soil in traditional gardening, you can bring up weed seeds that were previously buried too deep to germinate. Bringing them closer to the sun will make it easier for them to germinate.)

If you already have a lawn of annual weeds in your garden beds, you can add a layer of uncoated brown cardboard between the soil and any mulch you are planning to use. This cardboard will completely restrict light to the weeds and weed seeds that are on the soil surface and will smother them. The cardboard will still allow water to pass through and will decompose within a couple of months, further feeding the soil and providing food for our beneficial soil critters. (By the way, earthworms *love* cardboard!)

## LIVING MULCH

Living mulch is similar to a cover crop, but is usually a lower-growing ground cover that is grown *with* your main crop, and not planted as a preparation for planting the main crop. Many vegetables leave plenty of soil around them exposed to sunlight. A living mulch will fill that space, shading the ground and competing for space with any weeds that might otherwise germinate. Living mulch can create a habitat for beneficial insects to help you with pest control and weed control. Living mulch provides a habitat for crickets and ground beetles, which actually eat

small weed seeds. A study done by Michigan State University found that an average female cricket could eat 223 redroot pigweed seeds in 24 hours. That's 223 weeds not germinating in your garden because you provided a habitat for one cricket! You can continue to provide shelter for them through the winter by leaving cover crops growing or not cutting them down and removing them once they've been killed by the cold.

Another side benefit of growing living mulch is that flowers such as crimson clover will attract pollinators to your garden. Since living mulch is grown in and among your vegetables, it will bring those pollinators right into the neighborhood where you'll need pollination in order to get a harvest. The placement and spacing of living mulch will depend on the type of garden setup you choose to implement. If you choose to grow in rows, you can alternate rows of plants like tomatoes with a row of living mulch. If you choose to grow in blocks, you can outline the blocks with a living mulch "hedge." If you opt to grow in raised beds with lots of crop diversity (like I do), you can plant shorter cover crops in and among the main crops.

However you decide to use living mulch in your vegetable garden, it's important to not allow it to set seed during the growing season. You can prevent this by cutting it back by two-thirds, which will be enough to remove the blooms but still allow it to regrow throughout the season. You can then just throw the trimmings into your compost pile.



*Low-growing strawberries are an excellent choice for a living mulch hedge.*

## **COMPANION PLANTING FOR WEED MANAGEMENT**

Some companion plants are used strictly for weed management, and not necessarily to attract beneficial insects, to repel unwanted insects, or to attract pollinators. Here are some good companions to plant as living mulches that will help keep the weeds down in your vegetable garden.

### **CRIMSON CLOVER**

Crimson clover thrives in the cool season and is a great companion for tall, more robust cool season plants like brassicas. Broccoli, cauliflower, cabbage, and kohlrabi are all strong growers, and a skirt of crimson clover growing around them isn't going to shade them at all. The brassica family are also nitrogen-hungry plants and can share the fixed nitrogen in the roots of the crimson clover, which is a legume. Crimson clover is also a good choice to plant among fruit trees, nut trees, grapes, and corn. In these cases, it should be grown in a row between rows of these specific crops, and then mowed down before going to seed.





*Crimson clover*

## **ALYSSUM**

Alyssum is a great choice for use as a living mulch among smaller crops. Alyssum is low growing, so it won't shade out any crops. And it doesn't compete for water and nutrients because it doesn't need much of either to thrive. In addition to shading the soil and keeping weeds down, it has the added benefit of attracting beneficial insects to the garden.

## **LEAF LETTUCE**

Leaf lettuce, if sown thickly and harvested continuously via the cut-and-come-again method, can be a terrific living mulch for just about anything. It works well for shorter plants and can even tolerate some shade from taller plants like corn and beans. And of course, it's a living mulch that is also edible, which means it's great for saving room in a small-space garden.





*Leaf lettuce*

## **OATS AND CEREAL RYE**

You can plant oats as a cover crop before planting your main crop. If you cut down the oats before they flower, you can leave them right on the ground to dry as mulch, and then plant vegetable transplants right through the cuttings. The allelopathic oat mulch will help manage weedy garden areas. Growing a cover crop of cereal rye and cutting it

down prior to planting your main crop can help suppress weeds for several weeks. If you cut it down and leave it on the soil surface, it can suppress weeds for two to three months.

## **CUCUMBER**

If you want a main crop that is also allelopathic, look no further than cucumbers. The roots of cucumber plants exude allelopathic chemicals that will inhibit weed growth. You can also grow them as a cover crop or as a living mulch under taller crops like tomatoes because the large, flat leaves will shade the ground.



*Cucumbers*

## **PLANTING AT THE RIGHT TIME**

When using living mulches in and among your crops, it's important to know when the plants you are using as living mulch will grow and mature and also how tall and wide they will get. You don't want to have a crop of hairy vetch with your spring lettuces. They are planted at different times in a lot of climates, and they'll also overwhelm and choke



out your lettuce plants. A good rule to follow is to use annual living mulches with annual fruits and vegetables and perennial living mulches with perennial fruits and vegetables. Following this simple rule will help ensure that both your living mulches and your crops don't overwhelm each other.

Any plant that is on the bushy side can serve as a living mulch just as long as it doesn't outgrow its companions. If desired, you can use flowers you like and mix them in with your vegetables. Experiment with which plants look good together and which plants also "play well" together. Over a few seasons, you will find tried-and-true combinations you love and that work for you.





## What is Allelopathy?

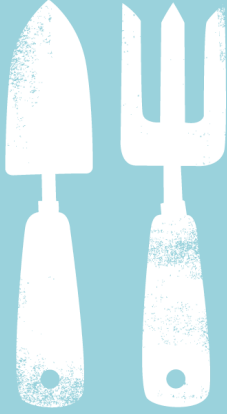
There is another, less talked about method of weed control that has been gaining popularity on organic and even some nonorganic farms. Allelopathy is a biological concept that describes the process by which one plant produces natural biochemicals that can have an effect, either positive or negative, on the growth and development of other plants around it. Sometimes allelopathic biochemicals can have a negative impact in your garden, such as when you plant a tomato plant near a black walnut tree. The allelopathic chemicals exuded by the walnut tree's root system can stunt the growth of the tomato plant or even kill it altogether. On the other hand, there are plants you can grow as companions or even as main crops that will suppress a weed seed's germination. While the primary research is being done for large-scale farming, the concept is still applicable to the home garden. One thing to keep in mind when experimenting with allelopathic plant combinations is that most of the positive allelopathic effects on weeds are related to seed germination rather than on the growing plants themselves. So in an area where you are using an allelopathic plant, you should stick to planting transplants and not use direct seeding of the beneficial plants.

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## CHAPTER 9

# VEGETABLE REFERENCE



**ARTICHOKE**

**ASPARAGUS**

**BEANS**

**BEETS**

**BROCCOLI**

**CABBAGE**

**CARROTS**

**CAULIFLOWER**

**CORN**

**CUCUMBERS**

**EGGPLANT**

**GARLIC**

**LETTUCES**

**ONIONS**

**PEAS**

**PEPPERS & CHILES**

**POTATOES**

**SQUASH & MELONS**

**STRAWBERRIES**

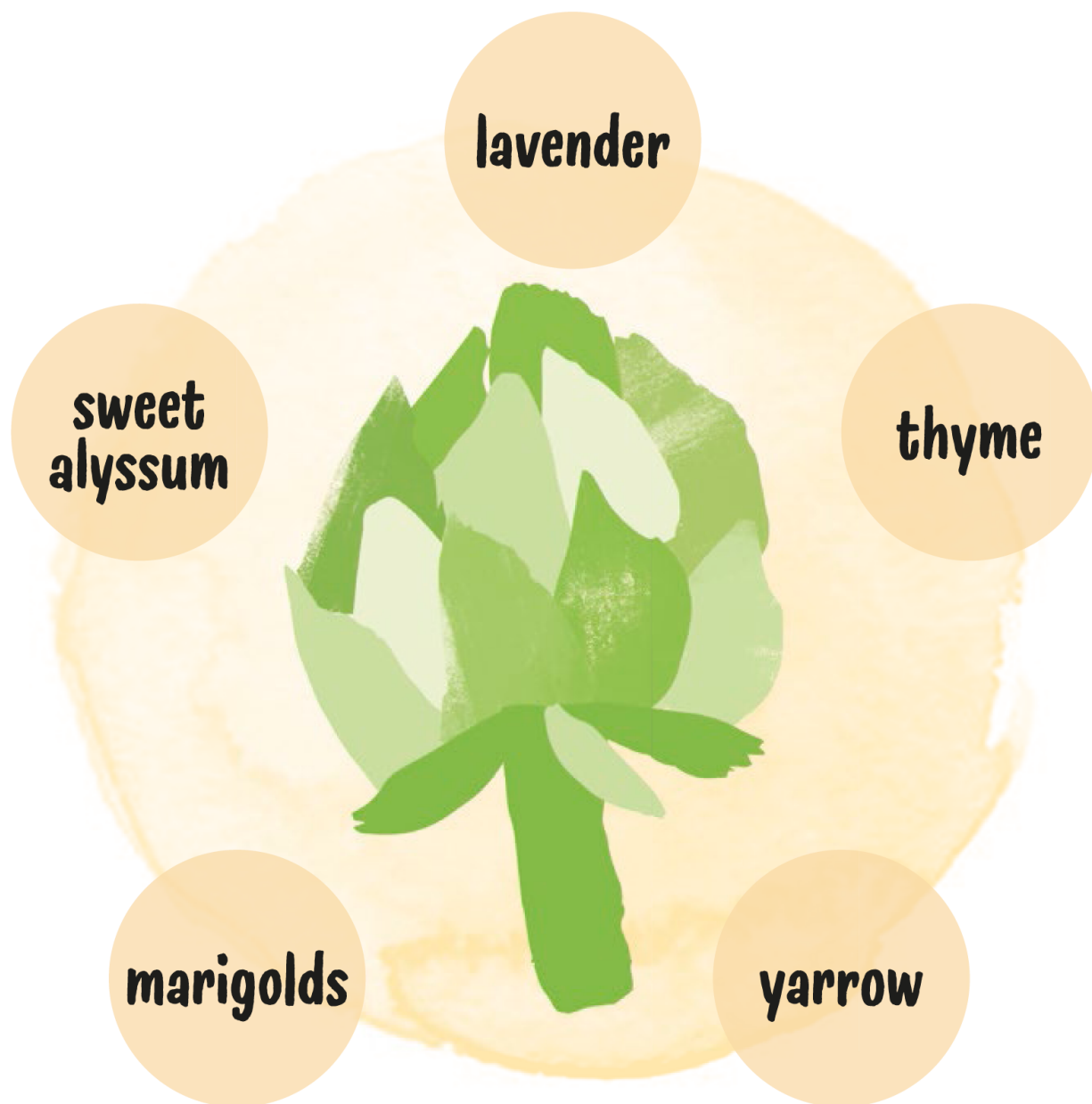
**SWEET POTATOES**

**TOMATOES**

## **ARTICHOKE**

**(CYNARA CARDUNCULUS VAR. SCOLYMUS)**

Artichoke is one of only a few perennial vegetables. It's an attractive silvery-green plant that lends itself to ornamental beds, as well as well as vegetable gardens. The edible part of an artichoke is the unopened flower. If you miss the harvest of an unopened flower, however, you won't be too disappointed—the flowers are just as attractive as the plants!



### **STARTING AND PLANTING**

The best way to start artichokes is with transplants and after all danger of frost has passed. You'll have an earlier harvest compared to using seeds. In shorter growing seasons, using transplants is a must. Since artichokes are perennials, you'll want to prepare the ground by adding lots of organic material such as well-rotted manure or compost. Artichokes like to be planted in rich, fertile, well-drained soil and in a full sun location. They should be spaced 4 feet (1.25 m) apart, as they

are large, spreading plants and like a little elbow room. They need a steady supply of water, especially in the first year of growing when the root system is developing.

## **GROWING AND HARVESTING**

If you live in a climate where you can grow artichokes as a perennial, the flowers will be smaller the first year and will develop later in the year, around September or October. You'll want to remove those flowers to allow the plant to use that energy for root and plant production. By taking this step, the plant will pay you back in subsequent years by producing, starting in May and continuing throughout the summer and into early fall. Artichoke plants will not survive temperatures below 20°F (-6.5°C), but can withstand a frost or freeze if they're protected. If you live in a climate with frosty winters, you can protect the plants by adding a 5 to 6-inch (13 to 15 cm) layer of mulch. In areas with snowy and icy winters, you will have to grow them as annuals. If you are in a colder winter climate and growing them as annuals, you can harvest the smaller blooms in September and October. An artichoke has main stems that end at the top with a large flower bud. Along that stem are secondary buds. Once the primary (top) bud is around 3 to 5 inches (8 to 13 cm) in diameter, it is ready to be harvested. You'll want to harvest while the bud is still firm and tight and before it begins to open. Harvest by cutting the stem about 1 inch (2.5 cm) below the bud. The secondary buds will be about 1 to 3 inches (2.5 to 8 cm) in diameter when ready to harvest.

## **COMPANIONS**

The best companions for perennial vegetables are other perennials. They can live with each other from year to year. The main pests for artichokes are the artichoke plume moth, aphids, and thrips. Perennials such as lavender, thyme, and yarrow can attract lacewings and damsel bugs, and annuals like marigolds and sweet alyssum will bring in hoverflies and parasitic wasps.



## **ASPARAGUS**

### **(ASPARAGUS OFFICINALIS)**

Asparagus is a perennial vegetable that can produce for 15 to 30 years, which will help make up for the fact that you'll need to wait two years after planting it to begin harvesting. You'll be able to eat the fresh shoots as they emerge from the ground in spring and then the plant will produce tall, ferny foliage for the rest of the growing season.



### **STARTING AND PLANTING**

Asparagus prefers rich, light, well-draining soil and a full sun location. Asparagus is started by planting the crowns; however before planting, it's imperative to amend the soil with lots of compost or other organic matter. (Asparagus plants will be living in the same bed for two to three decades, so it only makes sense to get them started right.) If possible, work the compost in as deep as 12 inches (26 cm). Plant the crowns 5 to 8 inches (13 to 20 cm) deep and 10 to 12 inches (26 to 31 cm) apart. Dig

a trench for planting and then create a small mound along the bottom of the trench. Sprinkle a liberal amount of bone meal or other phosphorus-rich organic fertilizer into the trench. If you have heavy clay soil, mix perlite or horticultural grit into the base of the trench to improve drainage. Set the crowns on top of the mound, spread the roots down the sides of the mound, and fill in the trench with amended soil.

## **GROWING AND HARVESTING**

Asparagus takes two full growing seasons to become well established. You should never harvest any spears the first year. It's best not to harvest any in the second year as well, but if you just can't wait, you can harvest a few of the very best and fattest spears, and leave the rest to become more established. Throughout the first two years, asparagus spears will emerge from the ground when the soil reaches 50°F (10°C). Once the new spears reach 8 to 12 inches (20 to 31 cm) in height, you can use a sharp knife to cut the spear off about 1 inch (2.5 cm) below the soil surface. You can harvest until about mid-June, but at that point, you must let it grow naturally to regenerate and prepare the next year's crop. Asparagus are very cold hardy plants, but in the coldest winter climates, they can benefit from a 3-inch (8 cm) layer of mulch.

## **COMPANIONS**

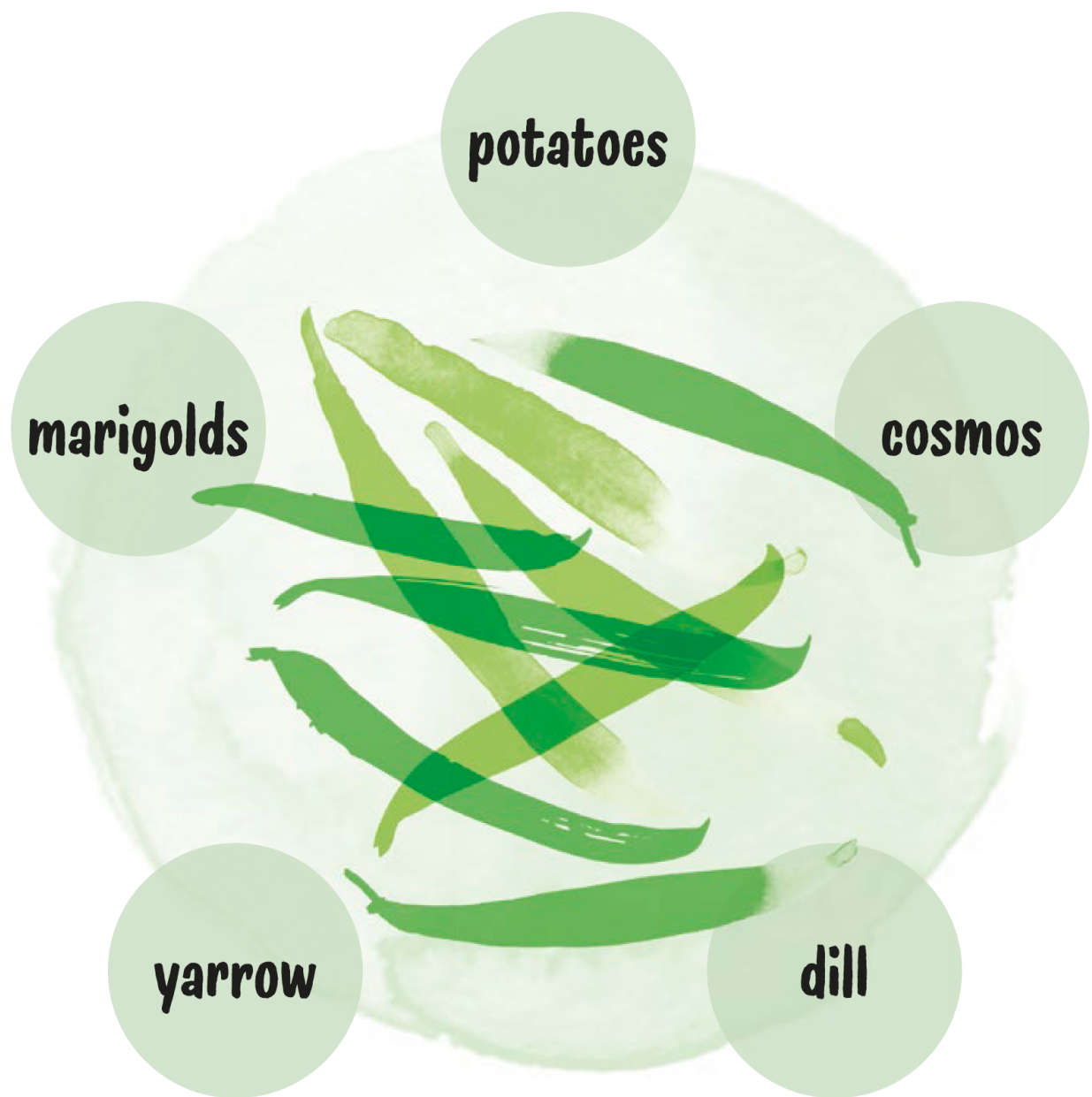
The best companion plants for perennial vegetables are other perennials. One space-saving companion crop for asparagus is strawberries. They root at different levels than asparagus, so competition for nutrients is minimal, and they both produce around the same time of year. They also are both long-living perennials. The most common pests for asparagus are aphids, asparagus beetle, armyworm, and cutworm. Perennials like lavender, thyme, and oregano can attract lacewings and damsel bugs, and annuals like marigold and alyssum will bring in hoverflies and parasitic wasps to help combat these pests.

## **BEANS**

### **(PHASEOLUS VULGARIS)**

In this section, I talk about two types of beans: bush and runner. Having two types of beans to choose from means you can grow beans in your garden no matter what size or shape it might be. You'll need to grow runner beans on a trellis of some kind. Bush beans are very prolific, but you won't need a trellis for those, you can even grow them in a container!





### **STARTING AND PLANTING**

Bush beans are compact plants that grow between 12 and 24 inches (31 and 61 cm) tall, and usually require little to no staking. Runner, or pole, beans, however, can grow to 10 feet (3 m) tall or more and require a trellis or teepee to climb on. Both types have similar requirements. They like very fertile soil with a great deal of moisture at all times. They also need full sun (six to eight hours per day) to produce well and to minimize disease susceptibility. Beans should be sown directly into

the garden; they don't like their roots disturbed through transplanting. After any danger of frost has passed, sow seeds for runner varieties 6 to 8 inches (15 to 20 cm) apart, and for bush varieties sow two seeds 6 to 8 inches (15 to 20 cm) apart at the base of each pole of a trellis or teepee. Keep them evenly moist until they germinate and then keep the moisture level high but not soaking wet throughout the season.

## **GROWING AND HARVESTING**

Beans don't need much fertilizer if they are sown into fertile soil; they supplement the nutrients already in the soil by taking nitrogen out of the air and storing it in nodules in their roots. You will eventually see bean flowers replaced by tiny little beans that will grow very quickly. In midsummer, when the beans are in full production, you may have to harvest daily. You'll want to pick beans when they are young: the best time is when they are about 6 inches (15 cm) long and you can just barely see the lumps of the beans inside the pods. That will be before any strings start to form and when the beans will be their most tender. That, of course, is for eating them fresh. If you plan to dry your beans, you'll want them to be long and the beans inside fully formed. I should mention that it's best to only harvest large beans at the end of the season. When beans are allowed to mature on the plant, it's a signal to the plant that its main goal of reproduction has been met and it can stop producing. If you keep picking small beans before maturity, the plant will keep producing.

## **COMPANIONS**

Beans have a variety of enemies, including aphids, spider mites, whiteflies, and Mexican bean beetles. Fortunately, there are some good companions that will keep each of these pests at bay. Potatoes are a great companion to beans because they will repel the Mexican bean beetle. In turn, the beans will repel the Colorado potato beetle, which is a frequent and destructive potato pest. Potatoes are also nitrogen-hungry plants, and beans will share the nitrogen fixed in their roots with them. Minute pirate bugs also help manage Mexican bean beetles and can be attracted by planting marigolds. Aphids and whiteflies can

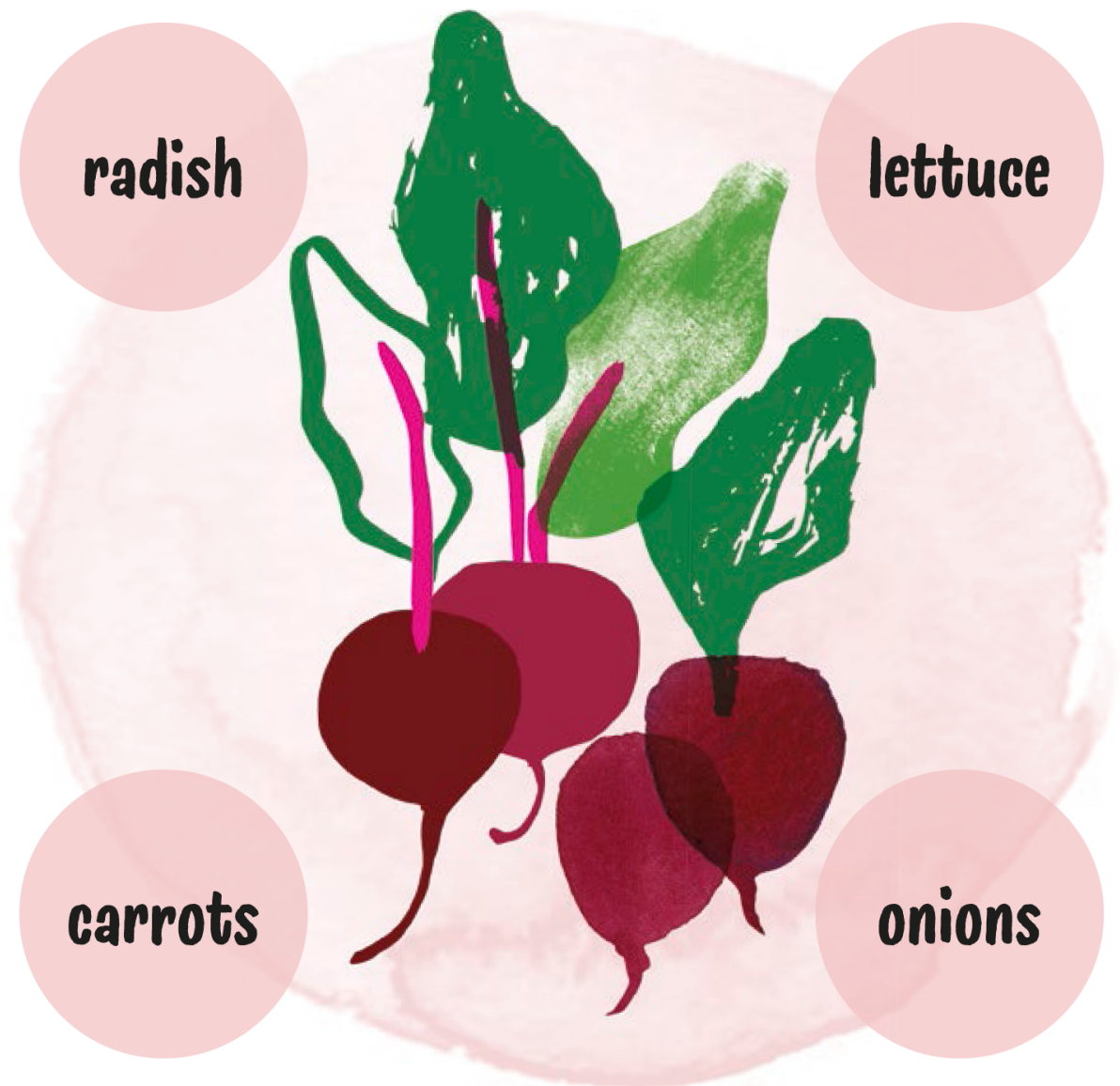
disfigure your beans and slow production, and spider mites can kill a whole crop of beans in no time if you have a large infestation. Attract lacewings to your garden by planting lots of cosmos, dill, and yarrow among your beans. Their larvae are voracious hunters and killers of whiteflies, aphids, and spider mites, and are one of the best beneficials you can have call your garden home.

## **BEETS**

### **(BETA VULGARIS)**

Beets are a crop that really gives it all: you can eat both the leaves and the roots! Most people are familiar with the bright red round roots that they see pickled in salads, but beet leaves are also tasty and nutritious and can be cooked just like spinach. Beets are a quick and easy crop to grow and can be grown among other slower maturing crops, even in partial shade.





### **STARTING AND PLANTING**

The best way to start beets is from seed. Each beet “seed” is actually a cluster of seeds that will produce a few plants. I always try to plant one seed per spot, that way I don’t have to thin them out. (Two to four beets will happily grow next to each other.) Beets are one root crop that doesn’t mind being transplanted, so you can plant transplants you grow yourself or plant transplants you purchase from a garden center. Space the seed pods or transplants 3 to 4 inches (8 to 10 cm) apart.

### **GROWING AND HARVESTING**

The best-tasting beet is a quickly grown beet. To grow them quickly, they need lots of rich organic material to grow in, constant moisture, and plenty of sun. Beets can be grown in partial shade, but the flavor of the root will not be quite as good. (The leaves are still tasty and plentiful, however.) Beets do better in cooler weather, making them good fall and spring crops for most climates and also good winter crops in milder climates. Once temperatures climb above 85°F (30°C), the plants will begin to suffer. To counteract the effects of the heat, you can cover them with shade cloth to spare them a little, but once it gets into that higher temperature range, it might be time to go ahead and harvest them.

Beet roots are ready to harvest at any time after they've reached the size of a golf ball; as they get bigger, the flavor will suffer and the roots will become more woody. You can harvest the outer leaves throughout the growing season, just be sure not to take off more than a third of the leaves at any one time.

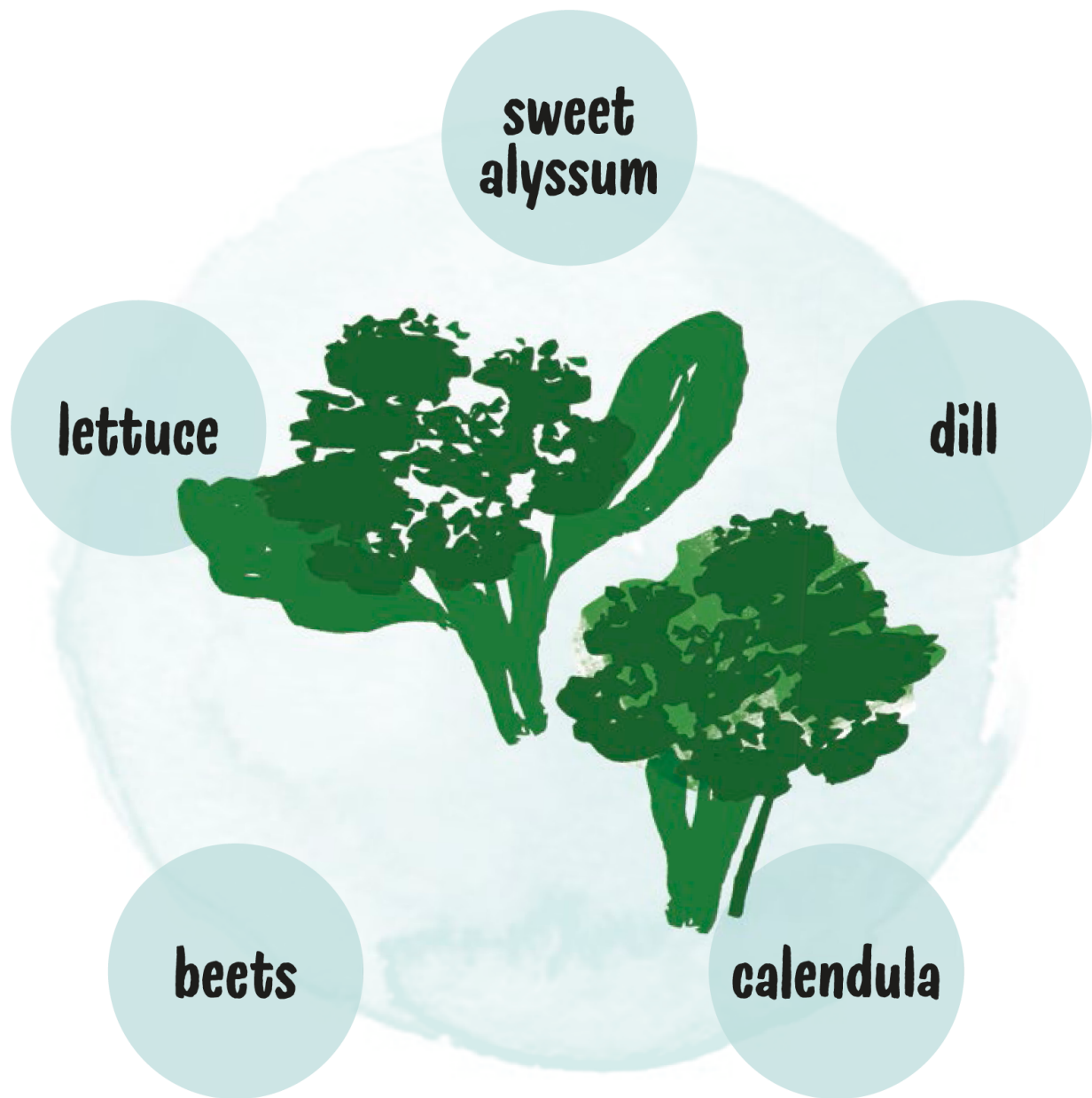
## **COMPANIONS**

Common beet pests include aphids, flea beetles, red spider mites, and cutworms. Good companion plants for managing these pests are radishes, onions, and carrots. Beets grow well with other root crops, and if you let some of the carrots go to flower, they will attract beneficial insects to your garden. You can save space and create more diversity by planting cut-and-come-again lettuces (lettuces that you can cut and harvest multiple times) between your beets.

## **BROCCOLI**

**(BRASSICA OLERACEA VAR. ITALICA)**

Broccoli might be a love-it-or-hate-it vegetable, but I love it and I also love growing it. It's a great cool season crop that can handle a little light shade, which we have plenty of in the cool season where I live. They are large, beautiful plants that can produce over several weeks. To add some real garden interest, try growing the 'Romanesco' variety.



### **STARTING AND PLANTING**

The severity of your winters will determine when you can plant broccoli. If you have mild frosts throughout the winter or no frosts at all, you can plant broccoli in late summer or early fall and grow it right through the winter. If you have freezing winters, you will need to plant your broccoli in spring. No matter which climate you have, you will either want to start from transplants or indoors from seed. For late summer or early fall planting, it's most likely going to be too hot to start



outdoors from seed; broccoli will only germinate in soil temperatures below 70°F (21°C). For spring sowing, you'll want to plant early because broccoli can take up garden space for about six months, meaning it can take up space you intend to use for warm season crops. You can start broccoli seeds indoors six weeks before your last frost date. Once your seedlings or transplants are ready to go into the garden (they are cold tolerant, so they can be put out two weeks before your last frost date), they will need at least four to five hours of direct sun and ideally six to eight, but they can also handle part shade. Plant them 15 to 18 inches (38 to 46 cm) apart in rich, well-draining soil, and make sure they remain moist.

## **GROWING AND HARVESTING**

Even though broccoli leaves are edible, most people grow it for the edible florets. The first floret will grow from the top center of the plant; it will start small but eventually grow to be much bigger. You will know it's ready to harvest when the tight flowers are just starting to look like they are just barely loosening up, and you will need to harvest them before they flower. Take a knife or some clippers and cut the stalk off just below where it starts to branch into the different segments. If you look down the main stalk from which the leaves grow, you will likely see baby florets starting to grow—these starts will eventually be your secondary crop. They won't get nearly as big as the main floret, but if you keep harvesting them, they will continue to produce.

## **COMPANIONS**

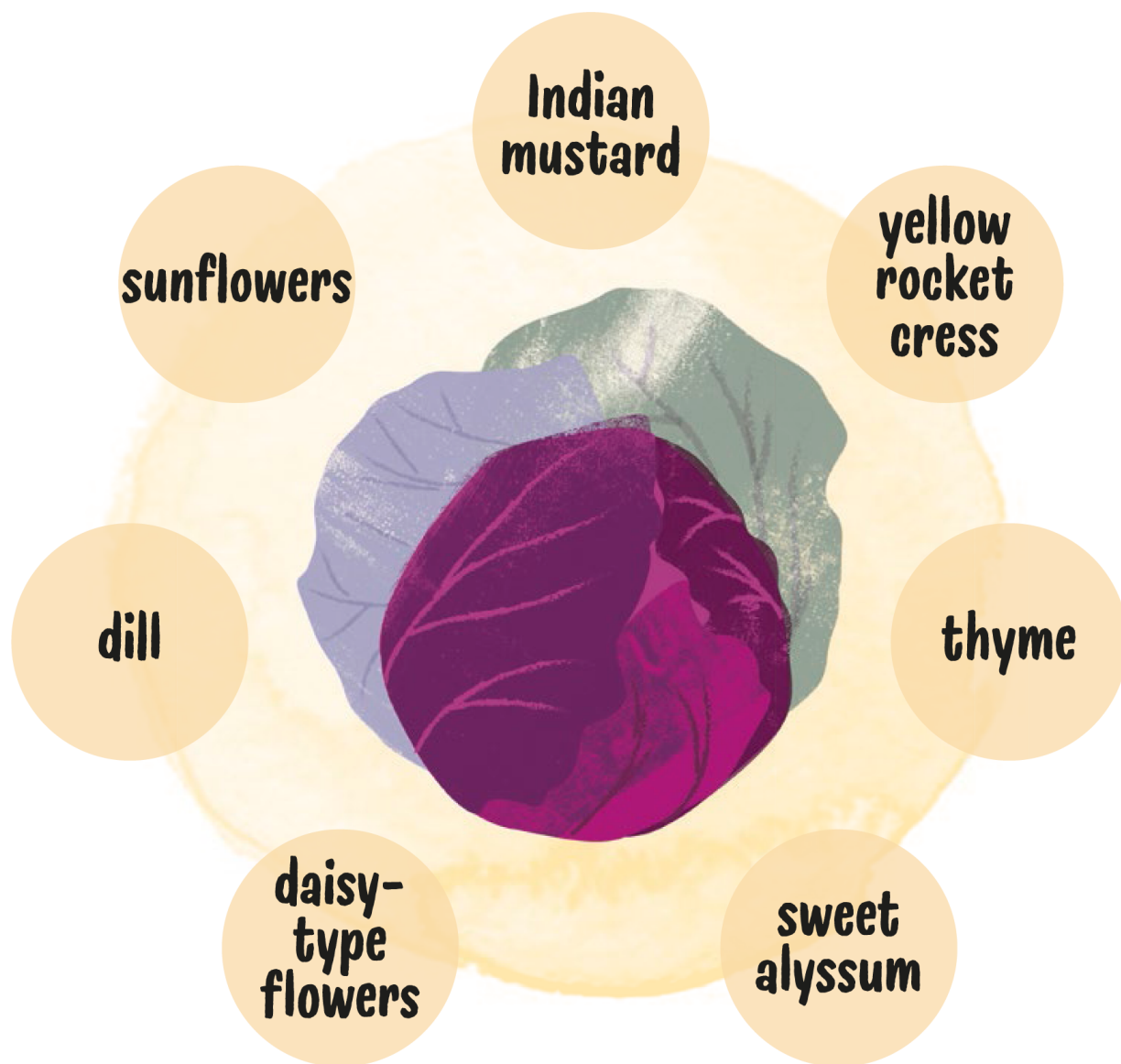
There are two approaches for planting broccoli companions. The first is simply for space-saving purposes. Broccoli can take up a good amount of space in the garden and do so for a long period of time, so you can underplant it with quick-growing crops like leaf lettuce, beets, and radishes to offset the broccoli taking up so much space. There are also companions that will help manage the two main pests that come for all brassicas in the spring: aphids and cabbage worms. Planting a carpet of sweet alyssum under your broccoli will attract hoverflies, and the larvae of the hoverflies will eat aphids. For any aphids the hoverflies miss, you

can plant calendula as a trap crop. Aphids love calendula, and many will choose that over your broccoli. You can handpick cabbage worms off of your plants or use Bt to control them; however, planting dill around them will attract parasitic wasps, which will lay eggs under the skin of the caterpillars, and the larvae will then eat them from the inside out.

## **CABBAGE**

### **(BRASSICA)**

Cabbages are easy to grow, and many varieties are so beautiful that they would look right at home growing among your ornamentals. Many can get quite large, but the amount of actual food you get for the space used is worth it. Their greatest threat is from aphids and the dreaded cabbage worm, but some simple strategies can keep these pests in check or eliminate them altogether.



### **STARTING AND PLANTING**

Cabbage is a cool season crop grown in the fall and spring. For spring growing, start seeds indoors six to eight weeks before your last frost date. For fall, and even winter growing in milder climates, start your seeds in the late summer or fall. Cabbages germinate best at temperatures lower than 80°F (25°C), so it might be difficult to start them in early fall if your summer weather is still above that temperature. If this is the case, you will need to start the seeds indoors six weeks prior to temperatures falling into the sixties and seventies.



Once your outdoor temperatures are in that range, you can transition the starts to the garden.

## **GROWING AND HARVESTING**

Cabbages love an open, sunny location but will tolerate partial shade. They like rich, moist soil and a bit of elbow room, as most varieties will get very large. Pay close attention to the spacing instructions on the seed packets. Once planted out, the seedlings are subject to attack by cabbage white butterflies, diamondback moths, aphids, and when the plants are still very small, birds. Floating row covers placed over the plants immediately after planting will protect your cabbages from most, if not all, of these pests. You will know the cabbage is ready to harvest when the head feels firm when you squeeze it. If it still feels loose, let it go a little longer.

## **COMPANIONS**

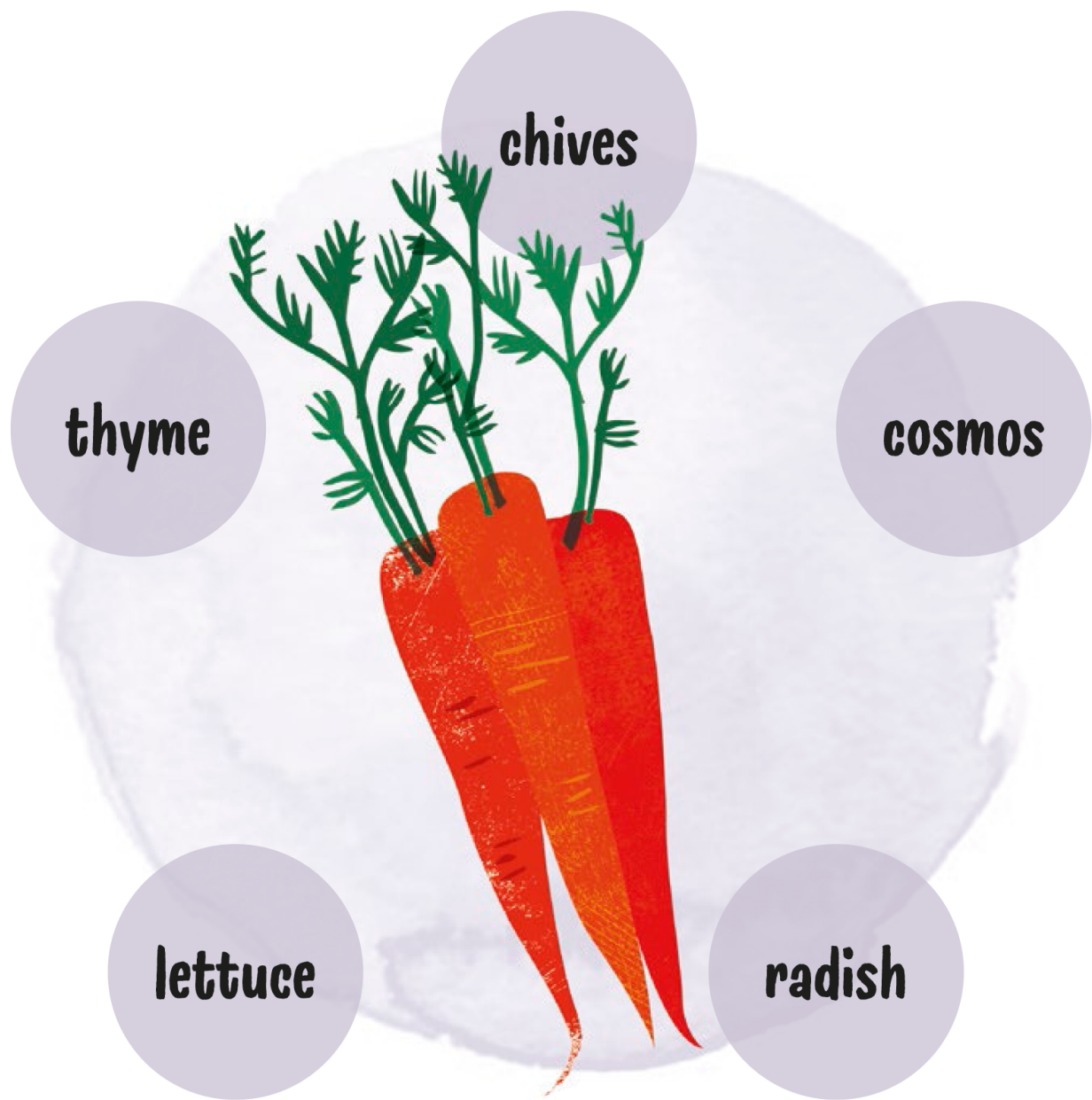
Trap crops work well for cabbages. The butterflies and moths that lay eggs, and whose caterpillars can devastate your crop, love plants in the brassica family because of the compounds in mustard oils. Indian mustard and collards are both good choices, but the best choice is yellow rocket cress, which has the highest concentration of mustard oils of the three. Research has shown that yellow rocket cress attracts butterfly and moth pests to lay their eggs on the plants, and once they do so the survival rate of the caterpillars is very low. Plant a trap crop about 10 feet (3 m) away from your cabbages. Once the eggs hatch and you have caterpillars thriving, you can pick them off by hand, or you can let nature do the work. Planting sweet alyssum around your cabbages will attract parasitic wasps, which will lay their eggs under the caterpillar's skin. The larvae will hatch and eat the caterpillar from the inside out. Another pest that relishes cabbage leaves are aphids. Aphids can be sprayed off of your plants with a hard jet of water, resulting in them drowning, but the humble ladybug can assist you before you have a huge problem with aphids. You can attract ladybugs to your garden by planting thyme and dill. Assassin bugs will kill aphids and caterpillars

and can be lured to your garden with a variety of flowers, including daisy-type flowers and sunflowers.

## **CARROTS**

### **(DAUCUS CAROTA)**

Picking carrots in my grandparent's garden is probably my earliest gardening memory. Root vegetables are fun to grow because you never quite know what you're going to get—some carrots can grow into some pretty interesting shapes! Carrots come in just about every color of the rainbow. Their airy, leafy tops are beautiful, and if you let them flower, you won't believe the display!



### **STARTING AND PLANTING**

In mild winter climates, carrot seed can be sown in the fall. In colder winter climates, you can sow carrot seed outdoors three to five weeks before your last frost date. Carrots don't like to be transplanted, so you will need to sow the seeds directly into the garden soil. Carrots like full sun but will grow with a minimum of four hours of direct sunlight. They like a moist, lightweight root run without a lot of nitrogen.



(Adding manure or other high-nitrogen materials to the soil will cause your carrots to twist and fork.) Carrots are notoriously difficult to germinate; they can take a while, but they don't like to be covered with any soil, which presents a challenge because the seeds have to stay moist at all times. One trick I use is to sow the seed and then cover it with a lightweight piece of wood or a piece of cardboard weighted with a rock so it doesn't blow away. After a few days, begin checking on your seeds once or twice a day to ensure the soil is always moist, and also check for germination. As soon as you see that half of the seeds have sprouted (they may only show a root and not leaves when they sprout), remove the wood or cardboard and let the sun in. Continue to keep them moist, and they will grow quickly.

### **GROWING AND HARVESTING**

Make sure to thin your carrot seedlings so there is at least 1 to 2 inches (2.5 to 5 cm) between each seedling. Cut off the remaining seedlings at ground level. (You can use the thinnings on salads, they taste surprisingly like carrots!) Keep carrots moist throughout the season and they will grow fast. The only way to truly know if a carrot is ready to harvest is to brush the soil away from the base of the plant to expose the top of the carrot root. If it looks to be the diameter it should be (all varieties are a bit different), it's time to pull it.

### **COMPANIONS**

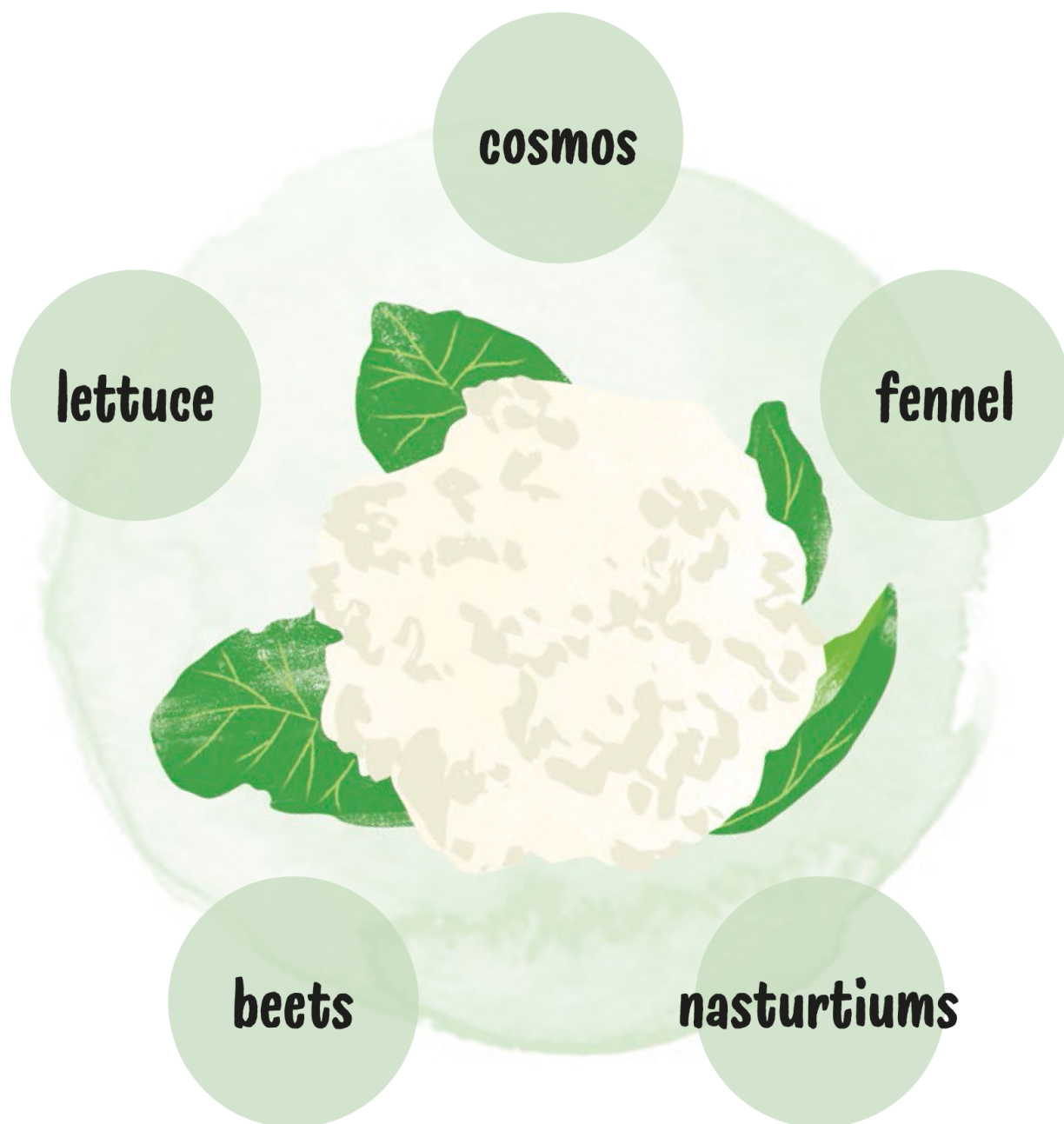
Cutworms can be very destructive to carrot seedlings and can wipe them out overnight. Planting thyme in your carrot bed a few weeks prior to planting the carrot seeds will attract damsel bugs, which will feed on cutworms and also carrot fly larvae. Carrot flies are a major pest for your carrot crop. They find carrots through smell, but you can mask the smell by planting a hedge of chives around your carrot patch; the strong chive smell will confuse them and persuade them to look elsewhere. Lacewing larvae are voracious aphid eaters. You can attract adult lacewings to your carrot patch by companion planting with cosmos. You can also use radishes as a trap crop by planting them a few

feet away. Let the radishes bloom to attract all sorts of other good bugs to your garden. Lettuce grows very well with carrots and will save space.

## **CAULIFLOWER**

**(BRASSICA OLERACEA VAR. BOTRYTIS)**

Cauliflower is a highly versatile cool season vegetable that can handle partial shade or full sun. These days, cauliflower is made into rice, bread, and crackers, but as a kid, I remember my mom smearing it with mustard, topping it with cheese, and baking it. Cauliflower comes in many colors, not just white! Try growing different varieties to add color to your garden and plate.



### **STARTING AND PLANTING**

If your winters have no frosts or just mild frosts, you can plant cauliflower in late summer or early fall and grow it all winter. If you have freezing weather and snow all winter, you'll want to plant your cauliflower in spring. No matter which weather scenario you deal with, you'll want to start cauliflower from transplants or indoors from seed. For late summer or early fall planting, it most likely will be too hot to



plant from seed; cauliflower will only germinate in soil temperatures below 70°F (21°C). For spring sowing, you'll want to get an early start on things because cauliflower, like broccoli, can take up garden space for four to five months, which can eat up space reserved for your warm season crops. You can start cauliflower seeds indoors six weeks before your last frost date. Once your seedlings or transplants are ready to go out into the garden (they are cold tolerant, so they can be put out two weeks before your last frost date), make sure they get at least four to five hours of direct sun, but the more, the better. Plant them 15 to 18 inches (38 to 46 cm) apart in rich, well-draining soil, and make sure they remain moist.

## **GROWING AND HARVESTING**

Even though cauliflower leaves are edible, most people grow cauliflower for the large central stalk and head. The head grows from the top center of the plant, and while it will start small, it will grow to be much bigger. Because cauliflower heads can become discolored by direct sunlight, you'll want to protect them once you see the leaves begin to part and the sun shine directly on the head. To do this, gather some of the leaves around the head and then rubber band or clothespin them together to protect the head from the sun. When a head is 6 to 8 inches (15 to 20 cm) in diameter and is still tight, it's ready to harvest. Take a knife or some clippers and cut the stalk off just below where it starts to branch into the different segments. Unlike broccoli, which continues to produce a secondary crop of side florets, cauliflower plants are done producing after you harvest the central head.

## **COMPANIONS**

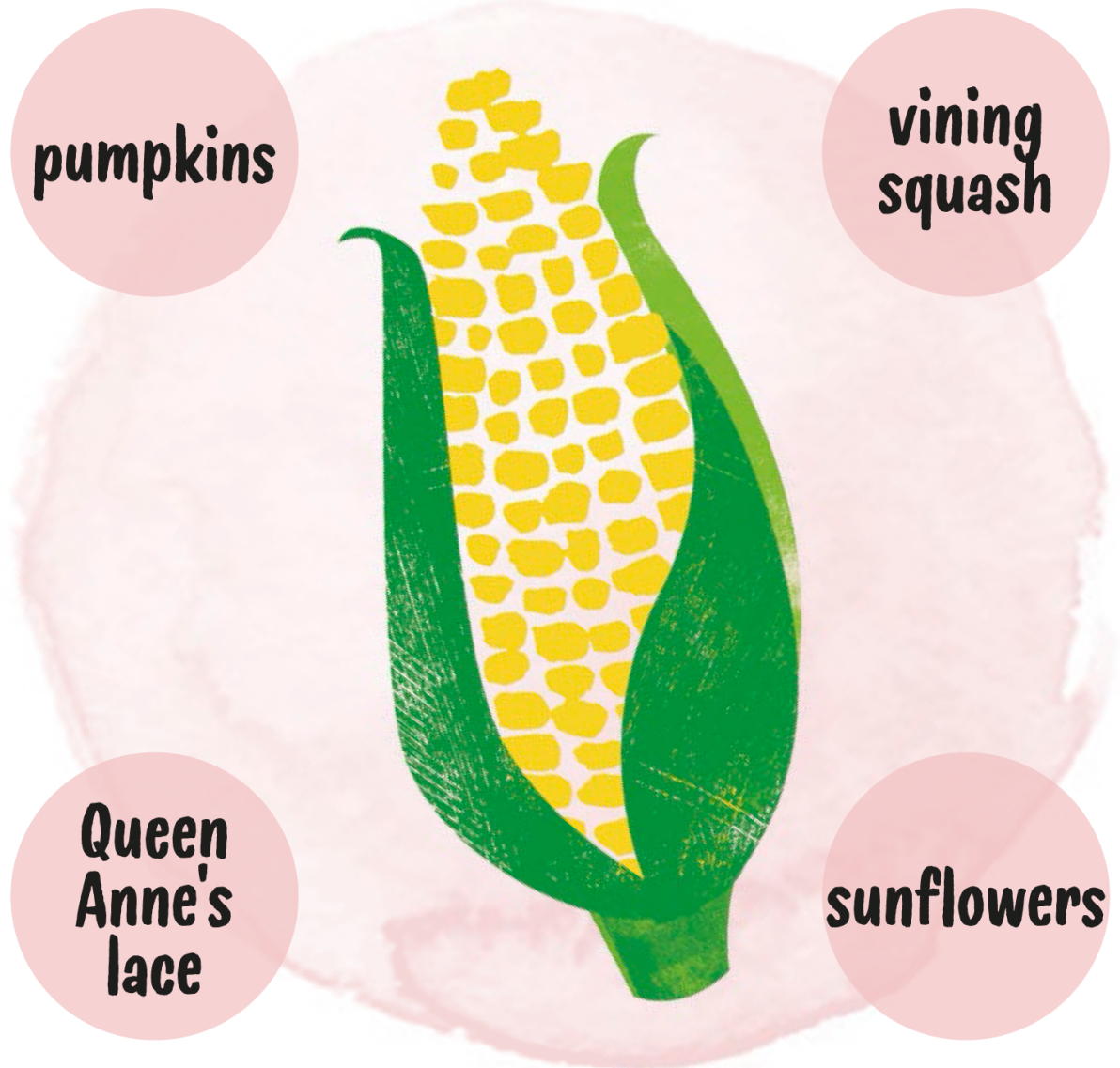
Cauliflower takes up garden space for long periods of time, and most of the growth is more than 6 to 8 inches (15 to 20 cm) off the ground. In that space, you can underplant quick-growing crops like leaf lettuce, beets, and radishes. There are also companions that will help manage the two main pests that come for all brassicas in the spring: aphids and cabbage worms. Companion planting with cosmos around your cauliflower will attract hoverflies, and the larvae of the hoverfly will eat

aphids. To give them some help, plant nasturtiums as a trap crop; aphids will love the nasturtiums even more than they love your cauliflower. You can plant fennel around your cauliflower to attract parasitic wasps, which will lay eggs under the skin of the caterpillars; the wasp larvae will then eat the worms from the inside out.

## **CORN**

### **(ZEA MAYS)**

If you've never grown your own corn, you have no idea just how sweet it can be! My dad grew sweet corn in our backyard when I was a kid, and I'll always remember just how delicious it was. If you have extra space in your garden, try growing it just once! Sweet corn isn't the only type you can grow. You can spice things up with popcorn or with a real beauty like glass gem corn.



### **STARTING AND PLANTING**

Corn is a warm season crop that doesn't like to be transplanted. Choose a spot with six to eight hours of full sun, and sow directly into rich, well-draining soil that's been amended with lots of organic material. Seeds should be sown 8 to 12 inches (20 to 31 cm) apart. Corn is wind pollinated, and the pollen from one cornstalk must be carried on the breeze to another, so it must be planted in blocks or in several rows together and not in one long row. Block planting assures that whichever way the wind blows, the pollen will be blown onto the corn and not onto bare ground or adjacent crops.



## **GROWING AND HARVESTING**

Corn grows very quickly, as it is a grass. You will see corn ears starting to form where leaves meet the stalk. When the plants are sexually mature, silks will start to form on the end of each ear; these silks are the female parts of the plants, and the male parts are the tassels at the tops of the plants. The tassels release pollen that is carried on the wind down to the silks for pollination. You will know corn is about ready to harvest when the silks begin to turn brown. At that point, pull back a little of the husk to reveal the kernels, which should look full and have white juice flow out when pierced with your fingernail. As soon as you pick the ears, the natural sugars will start converting to starch, so cooking the ears immediately will preserve all of the natural sweetness. (I'm not kidding when I say to have a pot of boiling water ready before you pick them.)

## **COMPANIONS**

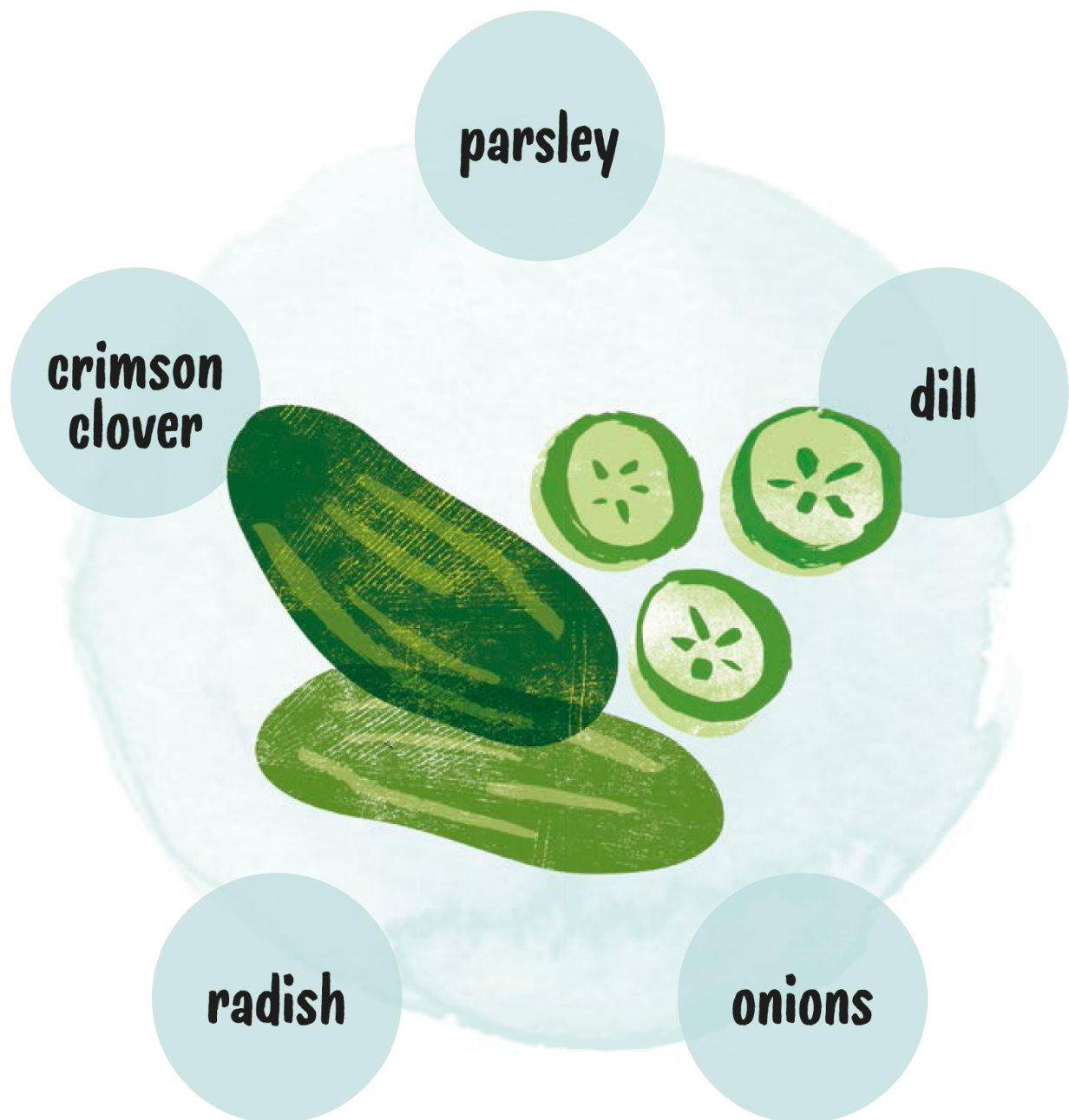
Corn earworm is quite possibly the most destructive commercial pest in the United States. The worm eats the kernels inside of the husk, and you may not realize you have them until you harvest. One way to fight these pests is to apply some mineral oil to the silks where they meet the ear. The oil will suffocate the worms. You can also plant sunflowers among your cornstalks. Not only does corn and sunflower growing together scream "summer" from the rooftops, the sunflowers will attract hoverflies, and hoverfly larvae love to feed on small caterpillars like corn earworm. They'll also take care of any aphids that happen to be on the scene.

Thrip is another common corn pest, and can be managed by attracting lacewings. You can attract lacewings to the area by planting some Queen Anne's lace here and there and around the sunny edges of the corn patch. There is a lot of bare ground under cornstalks that will invite weeds to grow. You can plant pumpkins and vining squash around the edges of the corn, and they will inevitably meander through the patch and shade the ground, helping to keep weeds from germinating. It's also a great space saver for these expansive vining crops.

## **CUCUMBERS**

**(CUCUMIS SATIVUS)**

There's nothing quite like the taste of a cold, fresh, crisp cucumber on a hot summer day. Cucumbers have a reputation for being difficult to grow, but they don't have to be if you know what they like and you know how to prevent the pests that like them. They make beautiful plants for growing up a trellis, where they can show off their blooms and display their hanging fruit.



### **STARTING AND PLANTING**

Cucumbers like hot weather, so you should wait to plant them in the garden until one to two weeks after your last frost date. You can start the seeds indoors four to six weeks earlier to get a head start.

Cucumbers like full sun and really moist, really rich soil, which means you can never add too much organic matter for them. However, even though they are thirsty plants, they don't want to sit in water, so they

still require good drainage, but you should never let the soil dry out. A good, well-balanced organic fertilizer applied every two weeks throughout the season will give you healthy plants and great production.

## **GROWING AND HARVESTING**

Cucumbers are a vining plant and can be grown along the ground, but I prefer to grow them on a teepee or trellis for a handful of reasons. First, cucumber vines take up a lot of real estate in the garden, and growing them vertically saves ground space for other plants. Growing them vertically also keeps the fruit off of the ground and away from pests that like to munch on the fresh cucumbers. Second, vertical growing also gets the flowers up in the air, where pollinators can get a better look at them, and it creates more airflow to keep diseases at bay. I like to harvest my cucumbers small—around 6 inches (15 cm). Once they get bigger than that, they can start to become bitter, more seedy, and develop a thicker, tougher skin.

## **COMPANIONS**

One of the reasons cucumbers are considered difficult to grow is the sheer number of pests that like to attack them. The cucumber beetle eats the leaves, flowers, and even the seeds while they are germinating. The dreaded squash bug also loves cucumber plants. Fortunately, tachinid flies love to dine on both pests. To attract tachinid flies, plant parsley and dill around your cucumber plants. Assassin bugs also like to eat these two pests and will show up if the pests they like are around, so keep them in your garden by providing bushy plants for them to shelter in. Crimson clover is a good choice, as it also fixes nitrogen in the soil that hungry plants like cucumbers can take advantage of. Crimson clover also attracts damsel bugs, which will help manage two other cucumber pests: aphids and whitefly. Planting radishes among your cucumbers and letting some flower will attract hoverflies, which will eat aphids and whitefly as well. Planting alliums like onions and garlic among your cucumbers can help deter red spider mites, which can do a

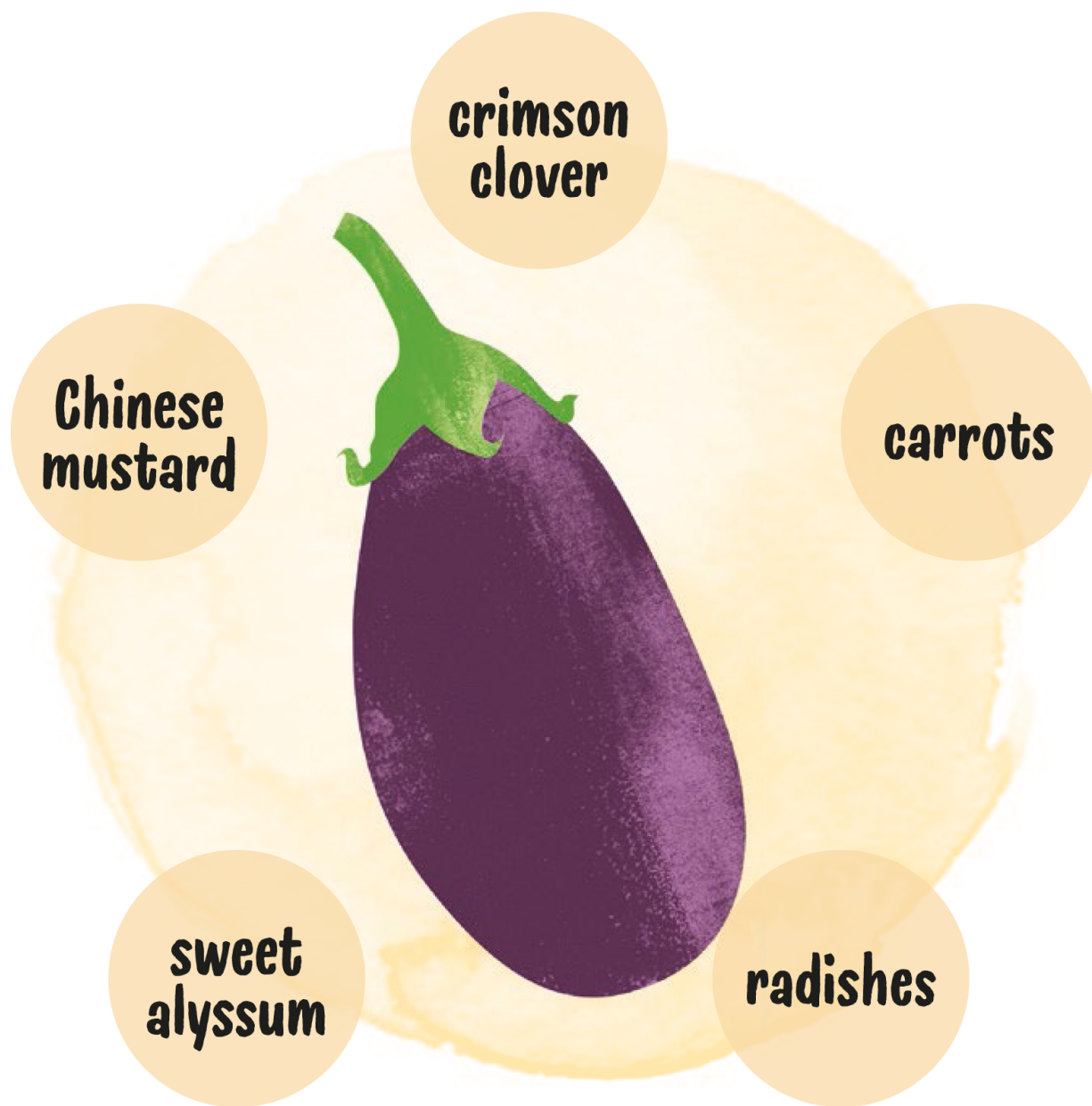


lot of damage to the leaves of your cucumbers and in a bad infestation, kill them off completely.

## **EGGPLANT**

**(SOLANUM)**

If you want to grow a crop whose plant is as beautiful as it's fruit, eggplant is the one to grow. I grow eggplant right in the front yard, among my ornamentals. Eggplants are large, heavy producers, and they are very easy to grow. They come in many shapes, sizes, and colors. And if you choose to grow the small white variety, you'll get to see how they got their name!



### **STARTING AND PLANTING**

Start eggplants from seed indoors about six weeks before your last frost date. Eggplants are heat lovers and shouldn't be transplanted outside until nighttime temperatures are at least 60°F (15°C). They are in the same family as tomatoes and peppers, which also like warm weather but enjoy drier conditions than eggplants which prefer a bit more moisture. Eggplants love to be planted 18 inches (45 cm) apart with full sun for six or more hours per day.

## **GROWING AND HARVESTING**

Once transplanted into the garden, the small plants are subject to a flea beetle attack. Adult plants are also susceptible to flea beetle but generally won't be killed. On the other hand, seedlings can be killed, so it's recommended you cover them with fleece or floating row covers as soon as you put them out to keep a physical barrier between the beetles and the seedlings. The barrier can be removed once the plants are about 1 foot (31 cm) tall. Eggplants are heavy feeders and need very rich soil, so a shovel full of compost in each planting hole will really pay off, as will fertilizing with a complete organic fertilizer every two weeks throughout the growing season. Staking is usually necessary to keep the plants upright, especially when they're full of fruit.

Harvest your eggplants young, while the skin is glossy and before the seeds inside turn dark. The fruit should give a little when squeezed. When the skin becomes dull, the eggplant will start to become bitter.

## **COMPANIONS**

Consider interplanting a variety of plants with eggplant, as diversity confuses the flea beetle. A living mulch of crimson clover will help camouflage the plants and will provide the added benefit of fixing nitrogen in the soil that hungry crops like eggplant can take full advantage of. Trap crops like Chinese mustard and radishes work especially well in luring the flea beetle away from your eggplants. Plant these trap crops among the eggplants, as flea beetles don't generally travel long distances. Braconid wasps are natural predators of flea beetles and can be attracted to the area by planting sweet alyssum and members of the carrot family and then letting them flower.

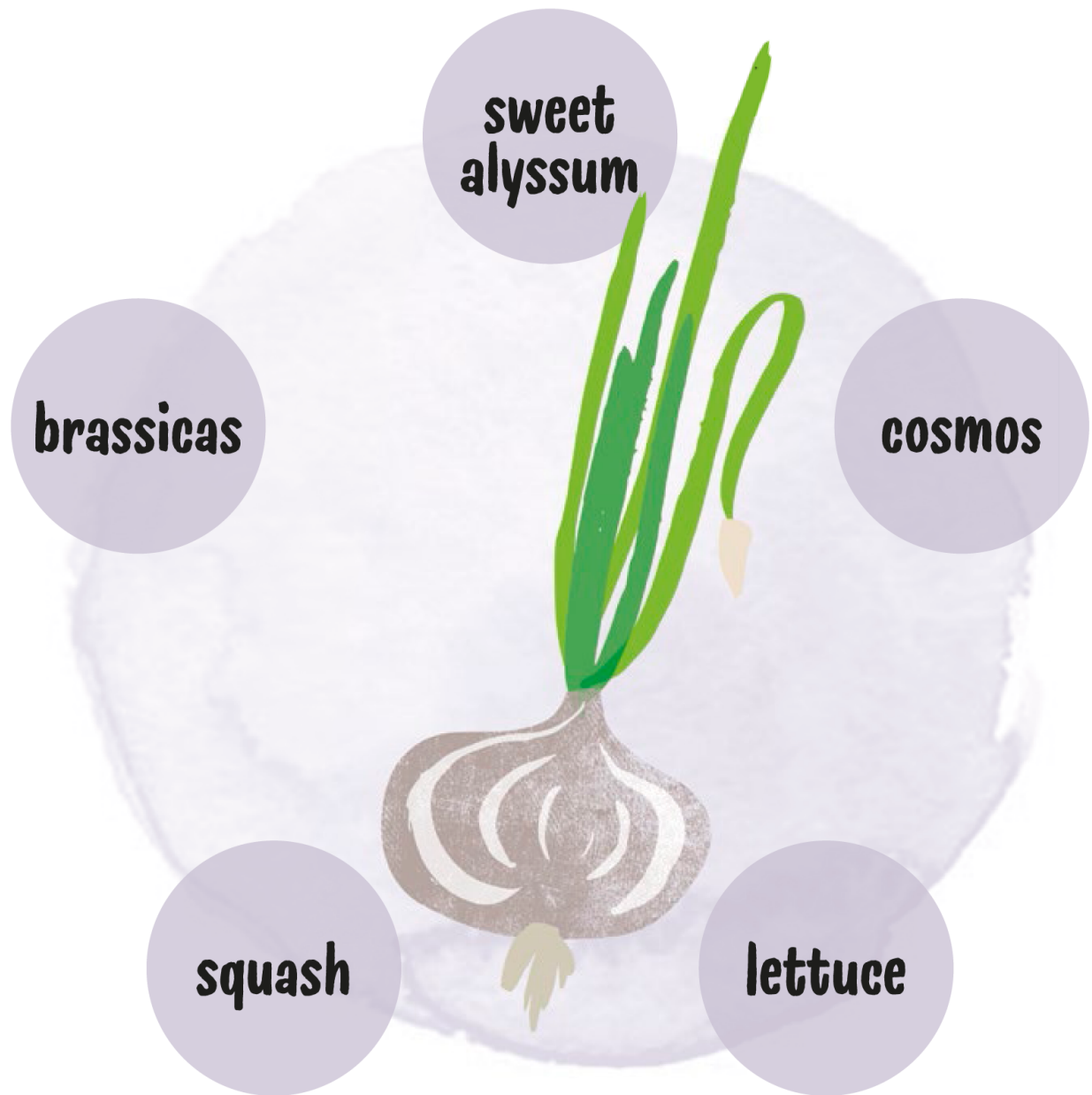
Eggplant is a member of the nightshade family and is susceptible to the same diseases as other nightshade vegetables; however, they don't seem to suffer as badly from disease as some other nightshade plants. I still like to keep all members of this family 10 feet (3 m) or more from potatoes, as they also are nightshades and often contract diseases earlier and more easily and can then pass them on to eggplants.



## **GARLIC**

**(ALLIUM SATIVUM)**

I don't know about you, but I can't get enough garlic! In recipes that use garlic, I add at least double what is called for. The leaves feature a garlicky flavor and are edible before the bulbs are ready for harvest. Growing garlic is easier than you might think; you can get a large harvest out of a very small space. Grow hardneck garlic to get the beautiful scapes (flower buds).



### **STARTING AND PLANTING**

There are two different types of garlic: softneck and hardneck. Hardneck garlic is a great choice for those who live in climates with cold winters, and softneck garlic is great for milder, more southerly winter climates. Garlic should be planted in the fall, and you'll want to make sure to get it in the ground before it freezes—six weeks before the first freeze is ideal. In climates where the ground never freezes, you can plant garlic through November and even into December. No matter

which type you are planting, you want to choose the strongest, biggest cloves; those will produce bigger plants and big garlic bulbs. Garlic likes a full sun location and rich, well-draining soil. Plant each clove pointy end up and about 4 inches (10 cm) deep, and plant the cloves 6 inches (15 cm) apart. Since they are bulbs, they like phosphorus, so put some organic phosphorus like bone meal in the bottom of the planting holes. Mulch the bed with a couple of inches of dried leaves, wood shavings, straw, or other material.

## **GROWING AND HARVESTING**

Garlics are almost plant-and-forget crops, they just need to be fed every so often, but that's about it. As long as the soil stays moist and is well amended prior to planting, they'll get by pretty well on their own. It takes about eight to nine months to get a harvest. You'll know it's about time to harvest when the bottom leaves turn brown and begin to dry up. The whole stem might also bend over near soil level. (Hardneck garlic will also send up flower buds called *scapes*, which can be cut off and used for cooking.) When these signs begin to appear, dig down a little next to a couple of plants and check the bulb size; if they look like they are full size, you can pull them up. You can eat garlic fresh, but if you've grown a lot of it, you'll want to prepare it to be stored so that it will last as long as possible. To prepare it for storage, brush the dirt off the bulbs, leave the stalks and roots intact, and lay them out in a single layer to dry or tie eight to ten bulbs together and hang them to dry, bulb sides down. They'll need to dry in a fairly dark and cool environment for three to four weeks or until the roots and stalks are dry and crispy, at which point you can cut off the roots and stalks and continue storing them in a cool, dark location.

## **COMPANIONS**

Fortunately, garlic doesn't have many pests. The biggest one I've run into is thrips. To combat thrips, plant a carpet of sweet alyssum under your garlic, or interplant cosmos among the plants. Both of these companions will attract lacewings, which are thrip predators. Instead of planting a whole bed of garlic, you can interplant it all over the garden.

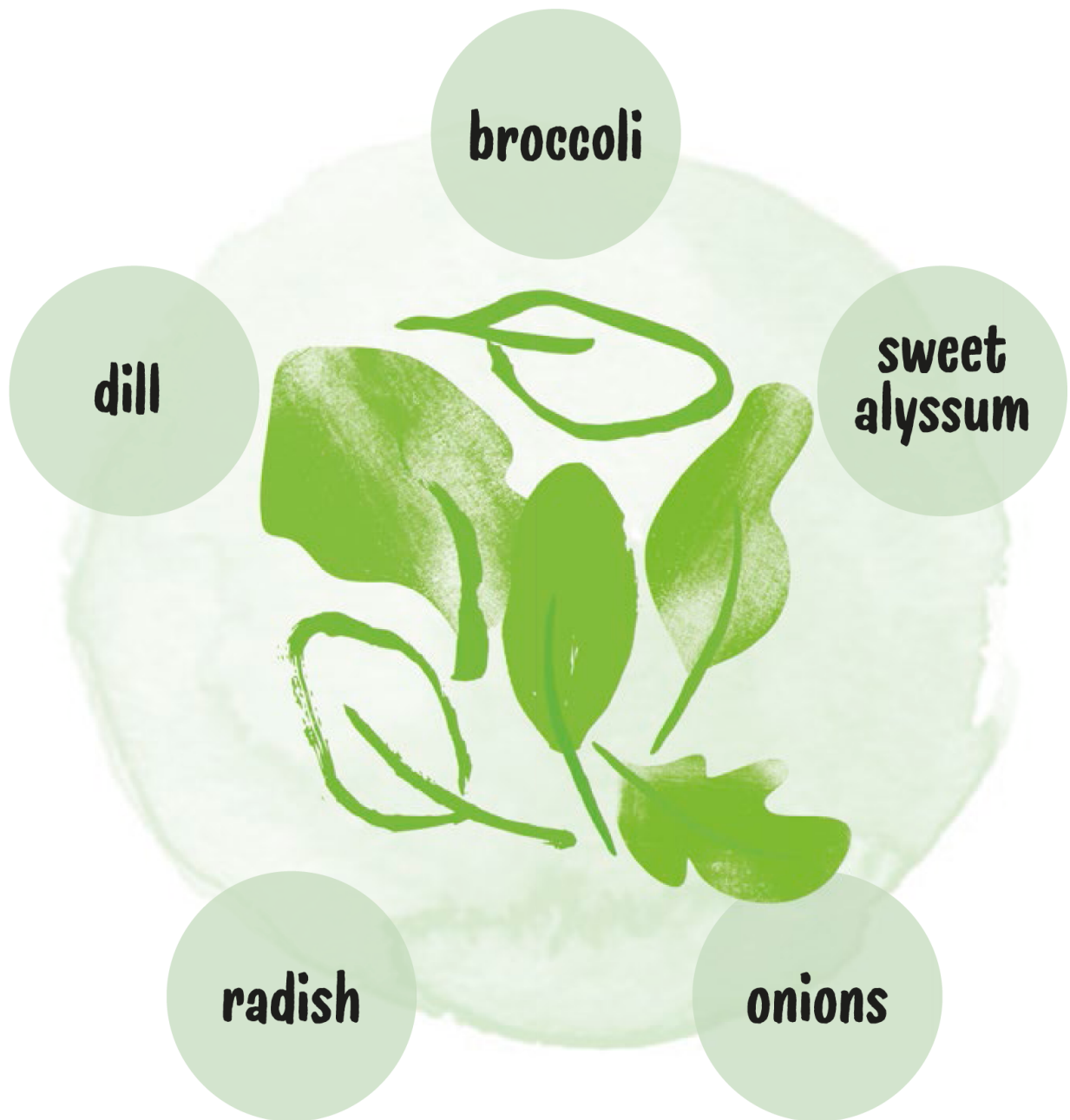
The strong scent of garlic will confuse pests like aphids and red spider mites, so you can plant garlic as a companion to crops that are heavily attacked by these pests, including lettuce and squash, as well as brassicas like cabbage, cauliflower, and broccoli.



# LETTUCES

## (LACTUCA SATIVA)

If you've never gardened before, lettuce is a great starter plant, especially leaf lettuce. It germinates and grows quickly, and you can start harvesting in less than a month. There are two main types of lettuce: leaf lettuce and head lettuce. Head lettuce takes up more space and takes more time to grow, while leaf lettuce is quick growing and can be tucked just about anywhere.



### **STARTING AND PLANTING**

Both leaf lettuce and head lettuce like moist, rich soil but will grow in most spaces and can even handle partial shade. Lettuce is a cool season crop and germinates very easily, just as long as temperatures remain under 80°F (27°C). The seeds are very small, and it's easy to sow them too densely, so they do need to be thinned to be about 4 to 6 inches (10 to 15 cm) apart for leaf lettuce and about 12 inches (31 cm) apart for

most head lettuce. (You can eat the thinnings.) If you hate pulling up hundreds of baby plants, take an old spice shaker and put a couple of tablespoons of sand in the bottle along with the seeds from one packet. Shake the ingredients of the bottle to combine them, and then sprinkle them onto the planting surface. The sand in the bottle will naturally space the seeds. You'll still likely need to thin a little, but nowhere near as much as if you were just scattering the seeds on their own. Most lettuces are surface sowed, but some varieties do need a thin covering of soil. Keep them evenly moist until they germinate.

## **GROWING AND HARVESTING**

As the plants grow, a liquid organic feeding applied every two weeks can help make more robust leaves. In the case of head lettuce, you'll want to make sure that the head is the right size before harvesting; it should feel firm and be completely filled out before cutting it from the stalk. You can treat leaf lettuce as a cut-and-come-again crop, meaning you can remove the outer leaves frequently for salads, and new growth will continue to grow in the center of the plant. You can also clip off the entire plant about an inch or two from the soil surface, and it will regrow within days. Using this method means you can get two or three harvests from each plant before it gives up. The plants will eventually give up, so it's best to practice succession sowing throughout the season, which mean you will sow some seed every couple of weeks so you'll have new plants coming along all the time to replace the older, worn out ones.

## **COMPANIONS**

Lettuce can sometimes be attacked by aphids, flea beetles, and cutworms. You can plant sweet alyssum next to lettuce to protect it from aphids. Alliums, like onions, have a scent that aphids don't like, and because they are a root crop, they won't mind sharing their soil with shallow-rooted lettuces. Plus, lettuces grow so fast, they will be done growing before the onions even start to bulb. Another slow-growing crop that makes a great space-saving companion plant for lettuces is broccoli. Broccoli takes up a lot of garden space for a long period of

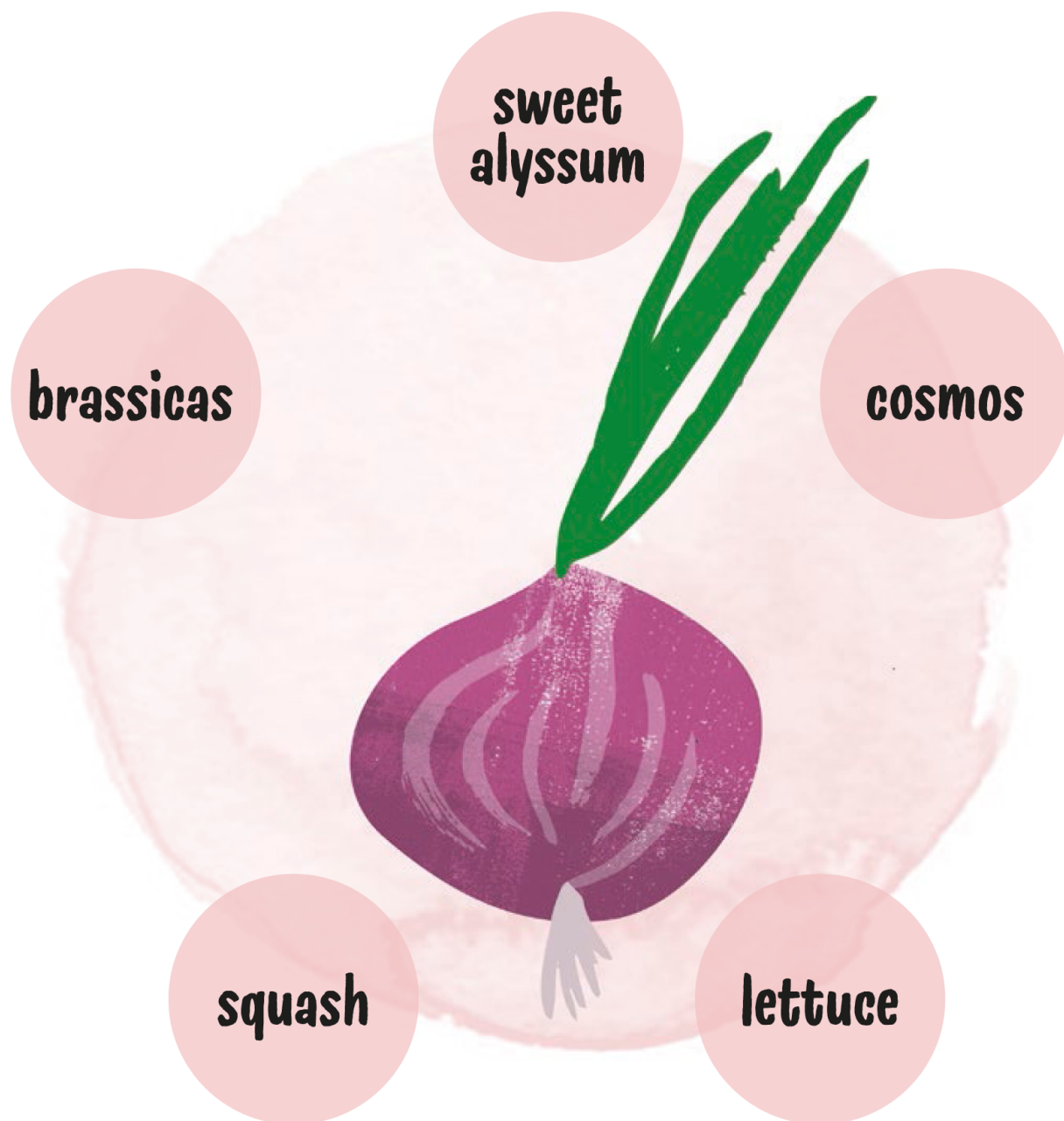
time, so you can have crop after crop of lettuce under one season of broccoli plants. Flea beetles like radishes even more than lettuce, so if you plant a trap crop of radishes with the lettuce, they will flock to the radishes. Cutworms can eat lettuce leaves or cut off the entire plant, so some dill planted among the lettuce will attract parasitic wasps, which will lay their eggs under the skin of the cutworm and the larvae will then eat the worms from the inside.



## **ONIONS**

### **(ALLIUM CEPA)**

Onions have been in cultivation for over 5,000 years. I can't think of many of my favorite recipes that don't include onions, and I find growing my own and cooking with them to be so satisfying. They're delicious and add so much flavor to so many dishes. They take up little space when interplanted with other vegetables, and they're easy to grow when you follow a few basic rules.



### **STARTING AND PLANTING**

Onions are *photo-thermoperiodic*, meaning they are very sensitive to daylight temperatures and daylight hours. An onion is stimulated to stop the growth of new leaves and start bulb production by the lengthening of days in spring, and different varieties need a specific amount of sunlight per day and for a specific number of days. If you are in the northern United States, you'll grow long day onions; in the central US, you'll grow intermediate day onions; in the southern US,

you'll grow short day onions. If you don't grow the right type of onion, you'll likely only get green onions (leaves), and not a bulb. In southerly, mild winter climates, sow short day onion seeds in mid-November or sow intermediate day onions in February. If you are in a colder winter climate, start seeds indoors eight to ten weeks before the last frost date. Sow a packet of seeds in a container about 8 inches (20 cm) square. The starts will come up like freshly sown grass, and for the next four weeks you should just let them grow. Four weeks before your last frost date, separate the starts and plant into the garden about 6 inches (15 cm) apart. Onions like full sun and rich well-draining soil.

### **GROWING AND HARVESTING**

Onions are fairly easy to grow. Make sure they get plenty of sunshine and moisture, and feed them every two weeks with a balanced liquid organic fertilizer, and you'll get nice large bulbs. When the stems start to bend over at the neck and just above the bulb, it will be time to harvest. When about half of the stems have flopped over, very gently bend the rest of the stems over at the same spot; this will signal the plant that it is time to prepare for dormancy. If possible, withhold water from the onions for about a week before harvest, and that will get the drying process started. When it's time for harvest, *dig* the bulbs up; don't just pull them out by the stem. If the stem rips near the bulb, you can introduce disease, which can keep the onion from lasting in storage. Brush any soil off of the bulbs and roots, and then lay them in a single layer to dry in the sun for three days. After three days, take them inside or place them in the shade in a single layer for another three to four weeks or until the leaves are crispy and brittle, at which point you can cut them off. You can remove a layer or two of the skin if it's overly dirty or you see mildew. Store in a cool dry place until use. Note that intermediate and long day onion varieties can usually be stored through the winter, while short day onions might only last three months.

### **COMPANIONS**

Onions don't have many pests. Plant a carpet of sweet alyssum around your onions or interplant cosmos to attract lacewings that will feed on

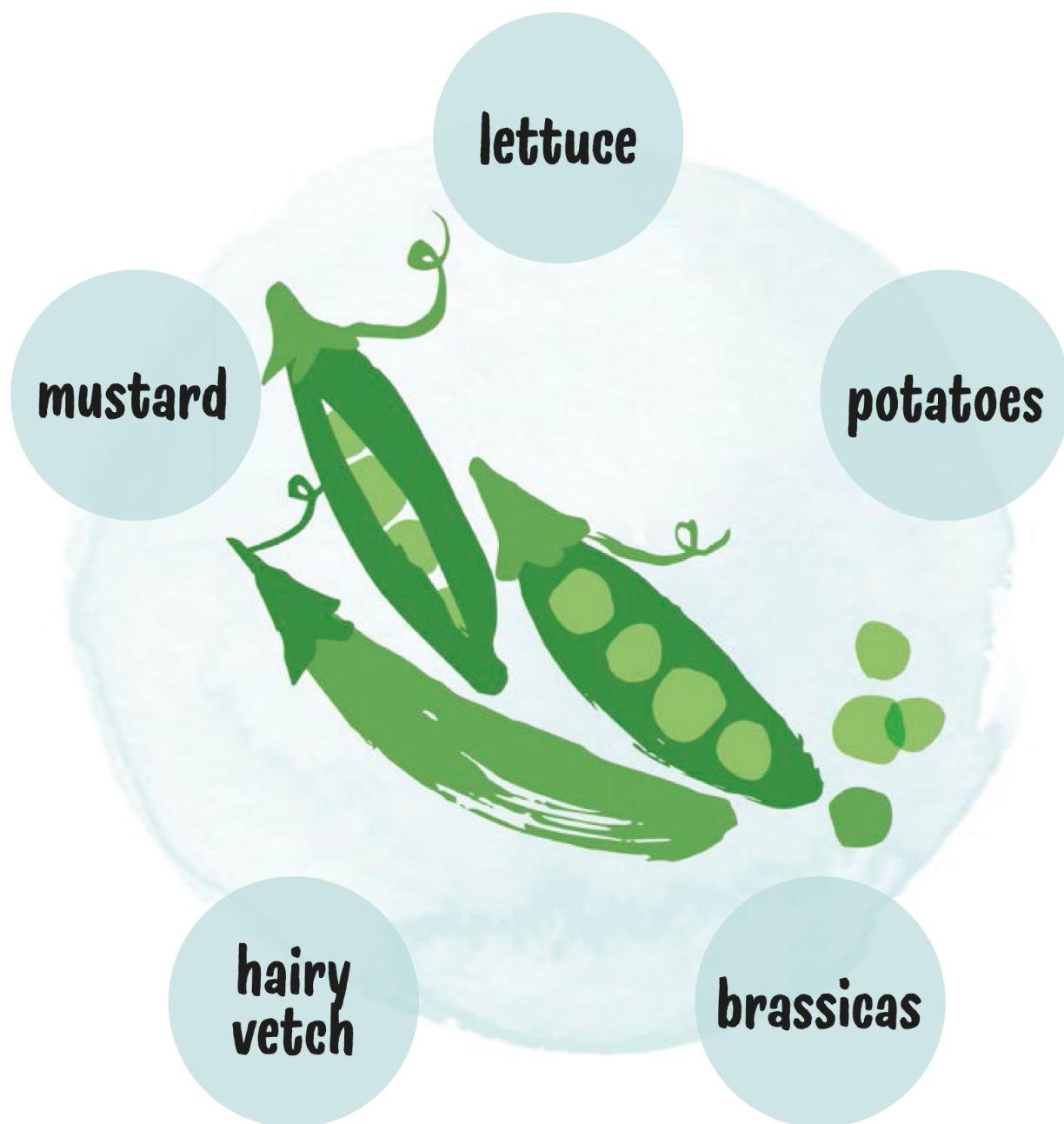
thrips. Instead of planting a bed of onions, interplant them all over the garden; the strong scent will confuse pests like aphids and red spider mites. You can plant onions as a companion for lettuce and squash, as well as brassicas like cabbage, cauliflower, and broccoli that are heavily attacked by aphids and spider mites. Just make sure the onions aren't shaded too much by their companions.



## **PEAS**

### **(PISUM SATIVUM)**

Peas are one of my favorite fresh garden snacks, which means they rarely make it inside the house. Eaten fresh or cooked, garden-grown peas are not the same as the peas that come canned or frozen in a bag. If those are the only two ways you've eaten peas, you're in for a real treat by growing your own! There are two types of peas you can grow: shelling peas and edible pod peas.



### **STARTING AND PLANTING**

The best way to start peas is sowing seeds directly in the ground, about 1 to 2 inches (3 to 5 cm) apart. They are cold tolerant and can be sown outdoors up to six weeks before your last frost date. Peas like a rich, consistently moist soil, so adding lots of organic material like compost before planting is a must. Make sure they are situated in full sun.

## **GROWING AND HARVESTING**

Peas need to be trained on some kind of a structure, as they are a vining crop. Bamboo teepees and cattle panels have always been my favorite ways to trellis peas. Keep in mind that some pea varieties can reach 8 feet (2.5 m) tall or more, so be aware of how tall the variety you're planting can grow and then plan your trellis height accordingly. When peas are less than 1 foot (31 cm) tall, they may need some training with learning to climb. I always tie the first 12 inches (31 cm) of each plant to the trellis. After that, they seem to figure it out on their own and will cover your trellis in no time. Peas are a cool season crop and will start to get diseased and die as temperatures rise in late spring and early summer, but if you have milder winters, you can sow peas in the fall and grow them right through spring. You can harvest snap peas as soon as you see peas starting to develop in the pod since these peas are grown mainly for eating the pod. For shelling peas, you'll want to wait until the pods swell and look nice and full.

## **COMPANIONS**

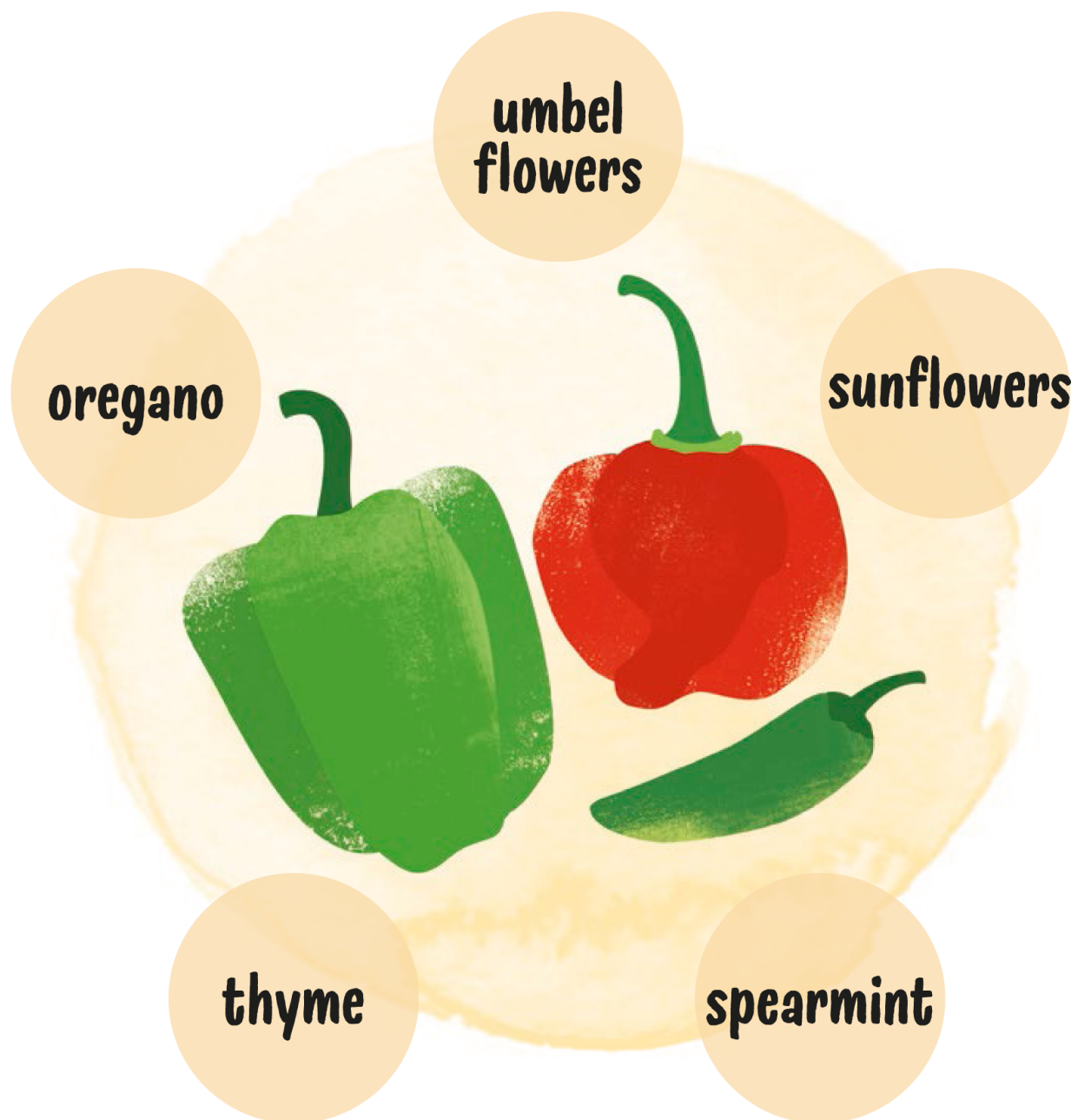
While they don't have a lot of pests that will bother them, aphids can be troublesome. Planting mustard around your peas can help attract ladybugs, which will feed on the aphids. Mustard can also help with certain fungal diseases like verticillium wilt. Other than mustard, you can also help protect peas against disease by planting hairy vetch between pea rows. Hairy vetch is known to protect peas against fusarium wilt, which is a common pea disease. Since peas are a legume and fix nitrogen in their roots, peas will share nitrogen with nearby plants. You can take advantage of this by interplanting peas with nitrogen-loving crops like lettuces, greens, brassicas, and potatoes.

## **PEPPERS & CHILES**

### **(CAPSICUM)**

Peppers and chiles are fun crops to grow, and come in a variety of shapes and colors. They vary in sweetness and hotness, and some even have beautiful variegated leaves. They are actually perennial plants and can be overwintered outdoors in mild winter climates. In colder winter climates, they should be brought indoors, which can give you a major jump-start on next year's crop!





### **STARTING AND PLANTING**

Start peppers from seed indoors about six to eight weeks before your last frost date. The hotter the pepper, the longer it will take to germinate. Bottom heat will cut the germination time drastically, so consider using a heat mat if you are starting them indoors. Peppers are heat lovers and shouldn't be transplanted outside until the minimum nighttime temperature is at least 60°F (15°C). In addition to warm

weather, they like moderate to moist soil. Peppers should be planted 12 to 18 inches (31 to 46 cm) apart in an area where there is full sun for six or more hours. They will benefit from some shading from the hotter late afternoon sun, as that can create sunscald on the ripening fruits.

### **GROWING AND HARVESTING**

Peppers are heavy feeders and need very rich soil, so a shovel full of compost in each planting hole will really pay off, as will fertilizing with a complete organic fertilizer every two weeks throughout the growing season. Staking is usually necessary to keep the plants upright, especially when they're full of fruit. You can harvest your peppers green or wait for them to turn color, which will result in a sweeter fruit.

### **COMPANIONS**

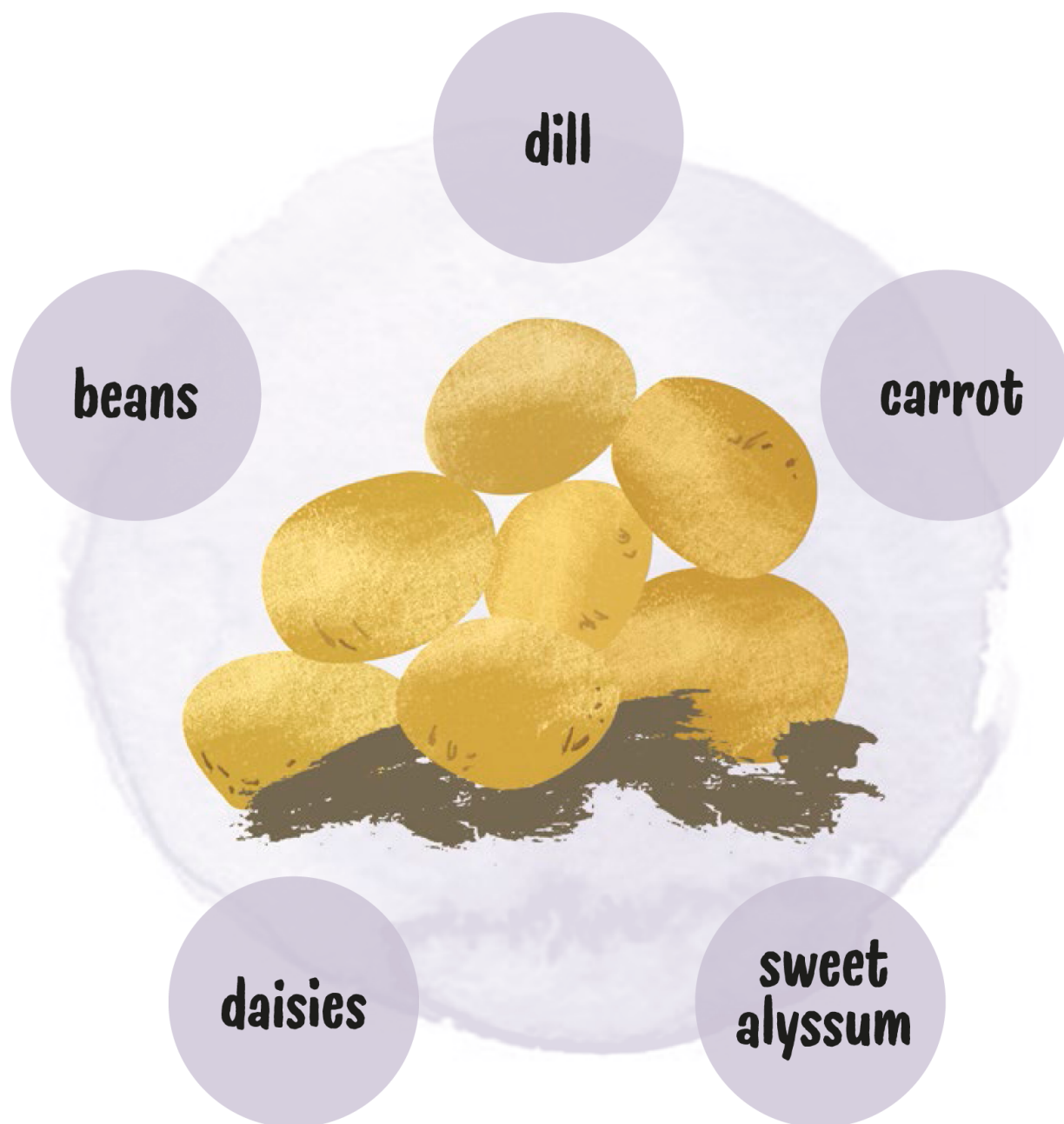
Peppers, and especially hot peppers, have relatively few pests. However, once the peppers are transplanted into the garden, there are a few pests to keep an eye out for. Leaf miners are small larvae of multiple types of flies and moths. They will tunnel between the upper and lower leaf layers, creating squiggly track marks all over the foliage. Sprays of any kind rarely work to eliminate these pests because they are protected by the outer leaf layers. The best method of control is to attract parasitic wasps with umbel flowers, which are plants composed of many tiny flowers arranged in an umbrella shape, such as those in the carrot family. Plants like cosmos, zinnia, yarrow, and alyssum also work well to attract parasitic wasps.

Pepper leaves can also be hosts to aphids. Alliums like onions will repel aphids and should be planted among your peppers. Spearmint and sunflowers, along with the umbel flowers, can attract minute pirate bugs, which are a predator of aphids. Just remember to always grow any mint in a container, as it can be very invasive. Of course, no talk of aphids could be complete without mentioning the ladybug which, as both adult and larvae, will eat thousands of aphids during its life span. Many of the above mentioned plants, in addition to herbs like thyme and oregano, will attract ladybugs.

# **POTATOES**

## **(SOLANUM)**

Potatoes are one of the most fun things to grow, and you never know what you'll dig up at harvest. Aside from the fun of growing them, the flavor of homegrown potatoes fresh out of the earth is something you just have to try. Take some new potatoes in the house and cook them right away: they have a taste and texture unlike anything you've ever experienced.



### **STARTING AND PLANTING**

“Chitting” is a process that will give your potatoes a head start before planting in colder winter climates. It also lets you know which potatoes are viable and which ones aren’t before you bury them in the soil. To chit potatoes, set seed potatoes in an egg carton in a dark, warm place about four to six weeks before your last frost date. Once they have broken their dormancy and the sprouts are about 1/2 inch (1.25 cm) tall,



place them in a sunny window. By the time your last frost date arrives, you should have about 2 inches (5 cm) of growth on your seed potatoes. Chitting or not, you can plant your potatoes in the ground two weeks before your last frost date. Plant them about 6 to 8 inches (15 to 20 cm) deep and about 12 inches (31 cm) apart.

## **GROWING AND HARVESTING**

The potatoes will break through the soil surface after your last frost. As they grow, you'll want to pull soil from between the rows and "hill them up," or cover up the stems and leaves with another several inches of soil. This "hilling up" does two things: first, it gives the potatoes more soil along the stems, and the stems will send out more roots making more potatoes under that added soil; second, it covers potatoes that are already growing and may be pushing themselves out of the soil which is not good. When too much sunlight hits a potato, it turns green and becomes poisonous.

When potato flowers fade and the plant starts to turn yellow, it's time to dig them up. The rest need to be cured. When first harvested, the skins are very thin and fragile. Rinse them, but do not scrub off the soil. They need to be stored in a cool, dark place for seven to ten days. During this time, the skins will thicken. After the curing process is over, sort through the potatoes and discard any that are soft or discolored. You can store them in the same cool, dark place, but make sure they are not closed up in a paper or plastic bag, as they do need air circulation.

## **COMPANIONS**

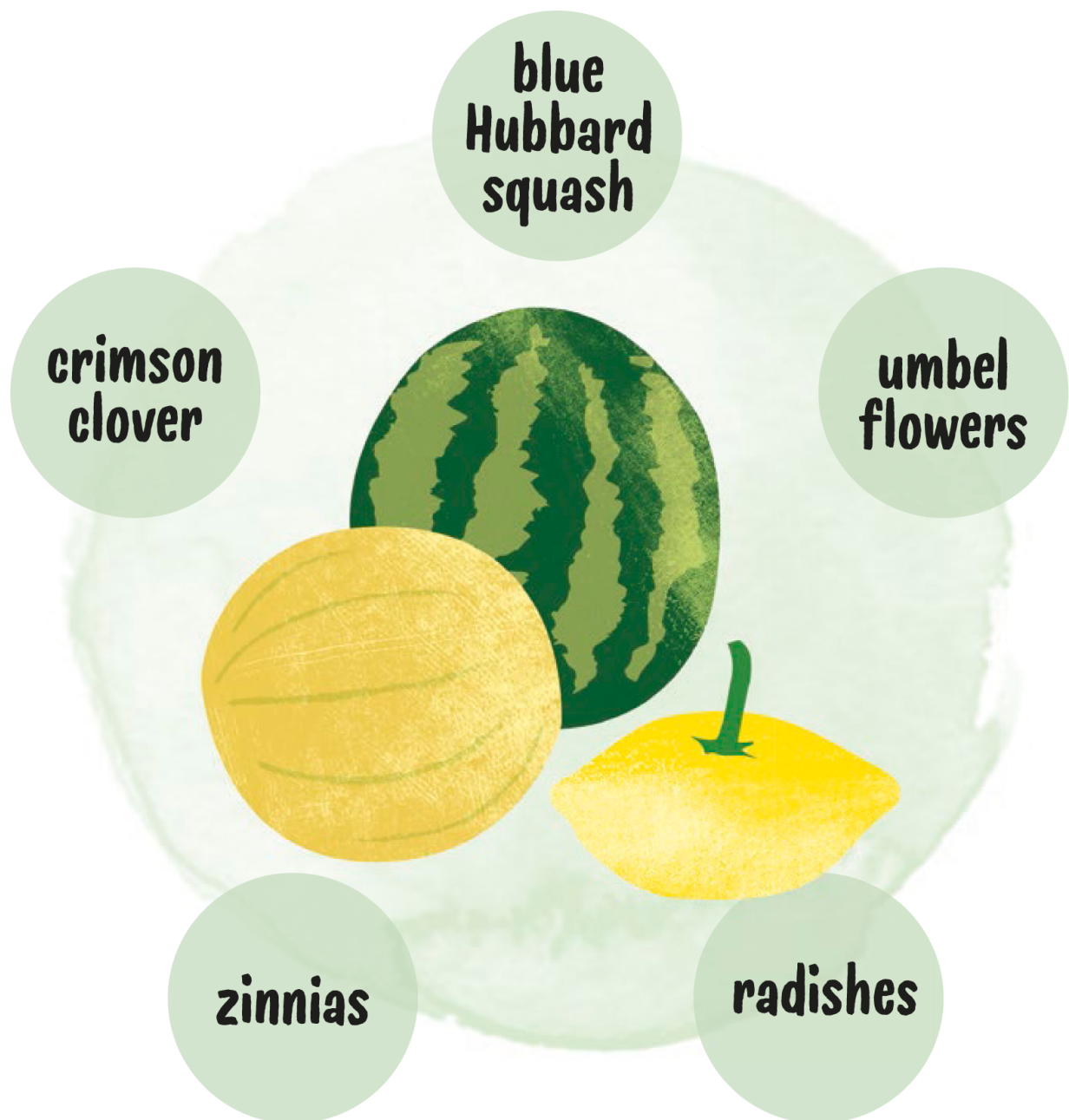
One of the biggest pests of potatoes is the Colorado potato beetle. If you have these bugs in your area, the best thing to do to prevent an outbreak is cover your plants with floating row covers. You can also attract beneficial insects to help deal with the issue. Insects like parasitic wasps, ground beetles, lacewings, and damsel bugs can all be lured to the garden by planting alyssum, daisies, carrots, and dill. (You'll need to let the carrots and dill go to flower.) Another good companion to interplant with potatoes is beans, which are known to repel or confuse

the Colorado potato beetle. Potatoes are a member of the nightshade family and share the same diseases as tomatoes, so make sure you grow potato and tomato plants at least 10 feet (3 m) apart to keep disease from spreading between plants. The other bad neighbor of potatoes is the black walnut tree. Its roots secrete a substance called *juglone* that will stunt or kill a lot of crops, including potatoes. The black walnut tree's root spread is about two to three times the tree's diameter, so be sure to plant potatoes far away from this tree's root system.

## **SQUASH & MELONS**

### **(CUCURBIT)**

Squashes and melons are fun crops to grow, but depending on where you grow them, they can be a challenge. If your garden is visited by squash bugs or vine borers, you know they can devastate an entire crop seemingly overnight. Fortunately, companion planting can help you outsmart these destructive pests and get a good harvest.



### **STARTING AND PLANTING**

Summer squash, winter squash, and melons all prefer to be sown directly into the garden, instead of being started early indoors. They have sensitive root systems and don't like being transplanted, which can slow their growth. They are fast-growing plants and heavy producers, so starting them outdoors after your last frost will give you plenty of time to have a plentiful harvest, even in short growing seasons. Squash



and melons prefer full sun; warm, well-draining soil; and constant moisture.

## **GROWING AND HARVESTING**

Squash and melons are heavy feeders and will benefit from a good amount of compost added to the bed before sowing, with biweekly feedings of a balanced organic liquid fertilizer. The most dreaded pests for squash and melons are squash vine borers and squash bugs. The squash vine borer moth lays an egg on the stem of the plant, and when the egg hatches, it immediately burrows into the stem and starts eating the stem from the inside out, eventually cutting off the plant from the soil and, in turn, from water and nutrients. To take care of this problem, cover the bed with floating row covers or fine netting when the seeds germinate (or even before) to keep the moths off of the plants. Keep the barrier in place throughout the growing season. Another option is to wrap the stem with aluminum foil from the first leaves down to the soil, and then mound up soil around the foil. The barrier will need to be adjusted as the stem thickens, but it will create another physical barrier between the moth and the main stem. For zucchini and summer squashes, you'll want to pick them young; wait any longer and they'll get seedy. (I pick mine when they are about 8 inches [20 cm] long.) For winter squash and melons, the skin will turn from shiny to dull when it's time to pick. Test the squash or melon by pushing a fingernail into the skin. If your nail bruises the skin but does not pierce it, it's ready to pick.

## **COMPANIONS**

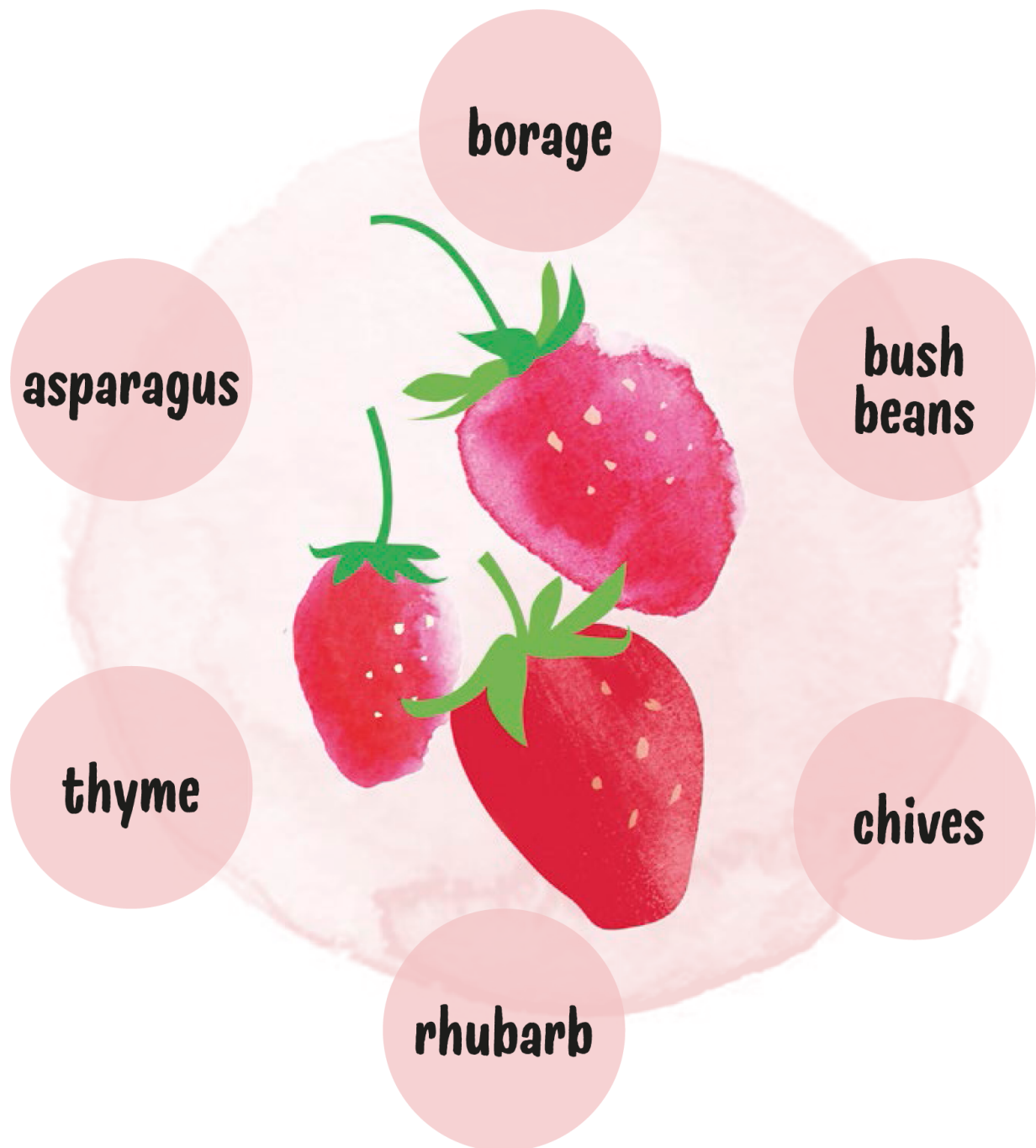
Parasitic wasp larvae can help eliminate the eggs of both the squash vine borer and squash bug, so planting umbel flowers like dill, carrot, and parsley throughout the garden will attract these tiny wasps. Another strategy is to plant a trap crop of blue Hubbard squash several feet away. Studies have shown that squash vine borers and squash bugs prefer this heirloom variety over all others, so it can lure them away from your zucchini. Plant blue Hubbards a month earlier than your main crop to give them a head start. Interplanting squash with radishes has been

shown to reduce the attack of cucumber beetle. Scatter radish seed around the bed and allow some to go to flower to attract other beneficials. Planting crimson clover and zinnias will give bees a much-needed pollen and nectar source. In my garden over the past several years, my harvests have been decreasing, which is a result of a lack of bees and a lack of pollination. You can hand pollinate your garden or create a bee-friendly garden by interplanting bright-colored flowers like zinnias and crimson clover.

## **STRAWBERRIES**

### **(FRAGARIA ANANASSA)**

Strawberries are fun and easy to grow. If you've never had a homegrown strawberry, warm from the sun and perfectly ripe, you've never really had a strawberry—there is a scent and flavor that is unrivaled. Most varieties are perennial, giving you fruit year after year. Strawberries establish themselves the first year, and then hit their peak by the third year.



### **STARTING AND PLANTING**

There are three types of strawberries you can grow: June-bearing strawberries, which ripen their fruit in one huge crop in June (depending on your climate, it could be a little sooner or a little later); ever-bearing strawberries, which usually produce through late spring, summer, and early fall; and day-neutral varieties, which can produce



over a longer season, like ever-bearing but are typically grown as annuals because they don't reliably overwinter. In mild winter climates, strawberry plants can be planted in the fall to develop their root systems throughout the winter. In cold winter climates, it's best to plant strawberries in spring and from bare root plants or transplants. Bare root strawberries provide the biggest bang for your buck and might start slower than transplants, but will typically take off and outgrow transplants by the end of the first season. Plant strawberries in a full sun location—the more sun they get, the more fruit they'll yield. Strawberries like consistently moist, well-drained soil, and they grow well in sandy soil that has been amended with lots of organic matter. If you have soil that is not well draining, consider planting them in a long, mounded row or in pots. Space your plants 12 to 18 inches (31 to 46 cm) apart to allow room for the runners to spread throughout the season.

## **GROWING AND HARVESTING**

A balanced liquid organic fertilizer will help the plants grow strong and produce large fruits and runners. When berries are fully red from stem to tip, you can harvest. You will need at least 30 strawberry plants to produce a good, usable harvest. Strawberry plants get better and better each year, producing more, larger fruits until after three or four years. Typically, after three years, the original plant will start to slow down and can be removed, but the runners will still continue on. Perennial strawberries can be overwintered without much fuss in mild winters and even in moderately cold winters. Just leave them in the ground and they will come back again in spring. In cold winter climates, where temperatures drop into the low 20s, plants will need to be protected by adding a 3-inch (8 cm) layer of mulch, such as pine needles or straw. The colder your winters, the thicker the mulch layer required. In spring, once freezing temperatures have subsided, you can remove the mulch layer.

## **COMPANIONS**

Asparagus and rhubarb are good choices for strawberries—they all stay in the ground year-round and their roots inhabit different layers of the soil. Chives produce a strong odor that can deter aphids, when planted between rows of strawberries. Strawberries need to be pollinated by bees, and borage will draw bees in like a magnet. Bush beans will share their fixed nitrogen with the neighboring strawberry plants and yet are short enough not to shade them out. Thyme is a great low-growing perennial and can attract damsel flies, which can take care of caterpillars, tarnished plant bugs, and certain beetle larvae.

## **SWEET POTATOES**

**(IPOMOEA BATATAS)**

Contrary to popular belief, sweet potatoes and potatoes aren't related; sweet potatoes are related to morning glories, and potatoes are in the nightshade family. Sweet potatoes make a beautiful landscape plant all season, and will reward you with a whole load of sweet tubers in the fall. Sweet potato vines do spread and take up a lot of space, but they can also be grown in large containers.



### **STARTING AND PLANTING**

Sweet potatoes need a six- to eight-week head start indoors before being planted outdoors. They're traditionally grown from *slips*, which are small vines that grow from a sweet potato and are taken from the potato early in the year. To start slips, you'll need an organic sweet potato (organic ensures that it wasn't sprayed with a sprout inhibitor) and a shallow container (with drainage) filled with indoor potting mix. In a



separate container, dissolve 1000 mg of vitamin C in 1 quart (1 L) of water. Submerge the sweet potato in this mixture for 15 minutes and then nestle it lengthwise into the potting mix so that only half of the potato is buried. Keep the potato moist and warm in a sunny window. In a week or two, you should start to see sprouts (slips) appearing. Once the slips are 6 to 10 inches (15 to 26 cm) tall, they can be separated from the potato. Some of the slips growing from soil level may have already rooted themselves, these can be planted in the garden straightaway. Others growing above the soil can be broken off and placed in a cup of water, and within a week or two, they will have enough roots to be planted out. Sweet potatoes like hot weather and sun. They want to grow in constantly moist but well-draining soil.

## **GROWING AND HARVESTING**

Sweet potatoes are pretty self-sufficient. You can ensure a good harvest, though, by feeding them every two weeks with a balanced organic liquid fertilizer until the leaves start to yellow in the fall. When the leaves yellow, it's a sign they are ready to harvest. Using your hands, carefully dig the tubers out of the ground. If you're using a shovel or fork, be careful; there will be tubers over a foot from the plant. Wash any soil from the potatoes and set them in the sun to dry for a full day, and then transfer them to a warm, well-ventilated location that is at least 85°F (30°C) for 10 days to cure. After curing, they can be stored in a cool, dry place for several months.

## **COMPANIONS**

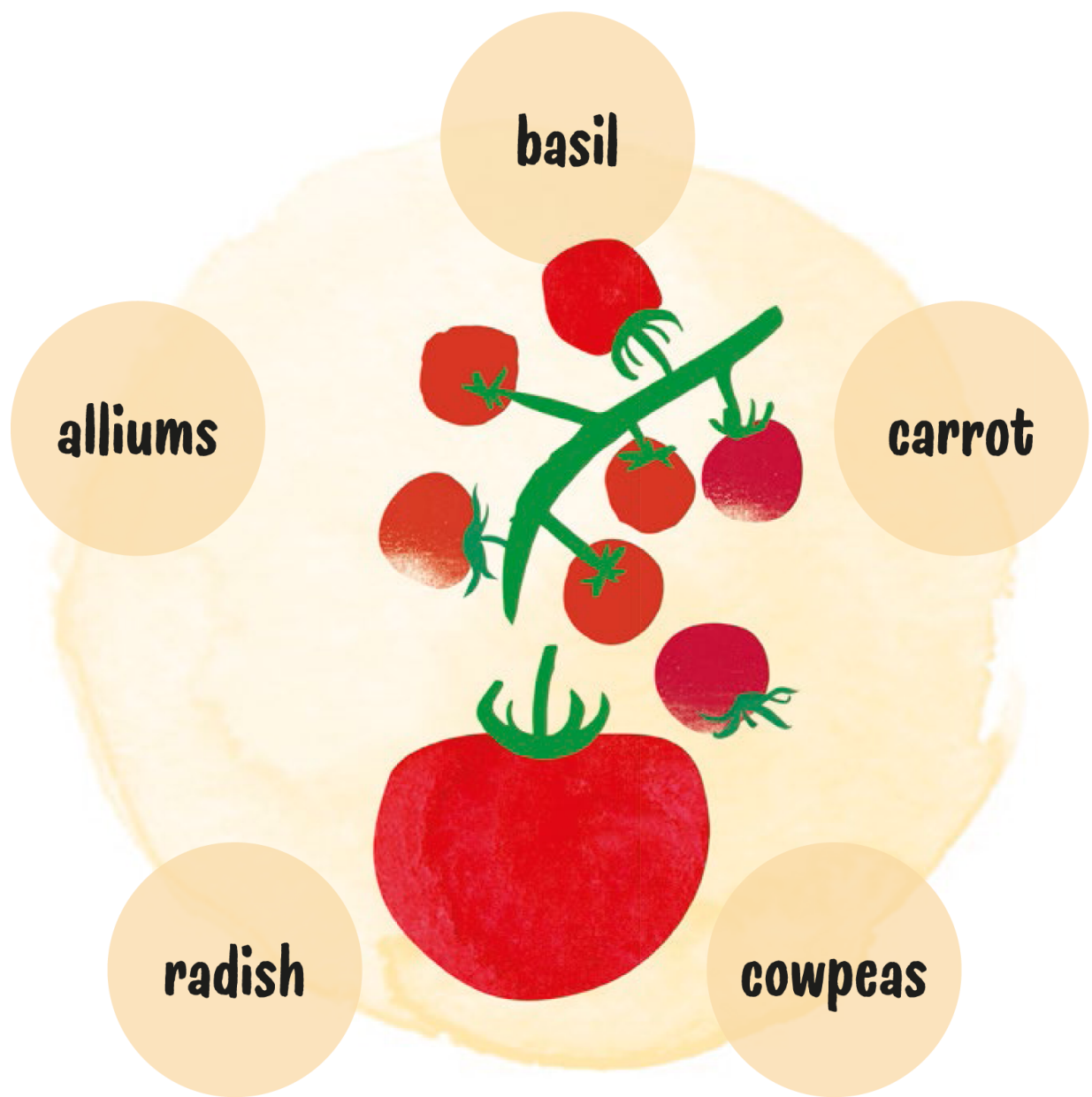
Sweet potatoes can be fairly pest-free in some locations, while in others they can be ruined by whiteflies, wireworms, armyworms, hornworms, loopers, flea beetles, cucumber beetles, and sweet potato weevils. But there are great companion planting options for all of these pests. Parasitic wasps and hoverflies can help manage all of the worms and can be attracted by planting statice and lemon balm. For flea beetles, plant a trap crop of mustard next to your sweet potatoes: choice varieties include Chinese Southern Giant and Pacific Gold. You can also set out yellow sticky traps to lure and trap the beetles. Companion planting

daisies among your sweet potatoes will attract tachinid flies, whose larvae will prey on the cucumber beetle larvae. Ground beetles are a natural predator of the sweet potato weevil and can be attracted by providing them shelter. The sweet potato vines themselves will offer shelter, but you can aid them by placing small stones or pieces of wood under your vines.

# **TOMATOES**

## **(SOLANUM)**

I consider tomatoes the reigning royalty of the summer garden; there are literally hundreds of varieties. They are definitely the most popular crop grown at home and for good reason—there is absolutely no comparison in taste between a store-bought tomato and a homegrown tomato. If you are like me and spent most of your life hating tomatoes, growing your own might just convert you into a tomato lover.



### **STARTING AND PLANTING**

I strongly suggest growing tomatoes from seed and choosing heirloom varieties. And while I'm not a big fan of red tomatoes, I think yellow tomatoes are a game changer. (My favorite is the Kellogg's Breakfast tomato—it alone made me a tomato lover.)

There are many ways to grow tomatoes, but I'm going to show you how I grow mine, because I think it's the most effective method for getting



the biggest crop, and it also presents the least amount of problems. You'll want to start your tomatoes indoors four to six weeks before your last frost date. (There is also a special way of sowing that will get your plants off to a flying start.)

To start your seeds, you'll need containers that are about twice as deep as they are wide. (I like reuseable 16 fl oz [475 ml] red Solo cups, as they are a perfect size.) To start, fill a cup half full with a seed starting mix and then sow the tomato seed about 1/4 inch (6 mm) deep into the mix. After the seed germinates and as it grows taller, continue filling the container with potting soil until the soil is almost to the top of the cup. (It's okay to cover the leaves just as long as there is still about a third of the leaves out of the soil at any given time. Tomatoes are unique: they grow roots wherever their stem touches soil, so by adding soil, you will be helping the plant build more and more roots as you continuously fill the cup with more planting mix.

After any danger of frost has passed and you've hardened off the seedlings, it will be time to plant your seedlings in the garden. Tomatoes love sun and need to be planted in a spot that gets at least six hours of direct sunlight each day but eight hours is ideal. You'll want rich, well-draining soil to plant in, so be sure to add lots of organic material like compost prior to planting. Plant your tomatoes deep! Hopefully your starts are 10 to 12 inches (25 to 30 cm) tall at this point. If so, dig 8- to 10-inch (20 to 25 cm) deep holes to plant them in. At the bottom of each hole, combine two good sources of phosphorus like rock phosphate (not superphosphate) and bone meal into the soil. Adding general nitrogen-rich organic fertilizers like kelp meal, blood meal, or crab and lobster shell will also help give the plants a boost. Plant your tomato seedling over the mixture and then fill in the hole around the stem. (You can remove the leaves that will be covered if you wish, but it's not necessary.)



*Cup For starting tomatoes*





*Filling cup around tomato seedling*

## **GROWING AND HARVESTING**

You'll want to feed your tomatoes with a liquid organic fertilizer every two weeks. Now you might think you're finished at this point, but you'll need to know what type of tomato you have: *determinate* or *indeterminate*. Usually the plant tag will say what type of tomato it is, but if not, you should be able to easily find the information online. Determinate tomatoes, like Romas, will grow to about 3 or 4 feet (1 to 1.25 m) in height, produce all their tomatoes, and then be done producing fruit. Indeterminate tomatoes, however, will continue to grow and produce fruit until frost kills them off. (In a frost-free or mild

winter climate, you can literally grow and harvest tomatoes throughout most of the winter, though production will slow down.)

The challenge with indeterminate tomato varieties is managing the incredible growth of these plants. I do this in two ways: pruning and trellising. Indeterminate tomatoes have a main stem, and they also have side growth, sometimes called “suckers.” I grow my tomatoes up the main stem and then prune off any side growth that appears in the armpit of the tomato plant. (The armpit is where a leaf meets the stem.) When you start to see new side growth in the armpit, you want to remove it to allow the plant to focus on producing fruit on the main stem rather than producing a bunch of new leafy growth. The side growth will put on some fruit, but it will be negligible.

Tomatoes can take six to eight weeks to ripen after being pollinated, so don't worry if it feels like your tomatoes have been green for a long time. Tomatoes are ready to be picked when they have completely changed from green to the color they are supposed to be. You can pick a tomato before it's totally ripe and it will continue to ripen, just as long as the tomato has developed some color before picking. (You should not put them in the refrigerator.) The best time to harvest a tomato is in the afternoon and preferably after withholding water (and definitely not after it has rained). Water can dilute the sugars in tomatoes and make them taste bland.





*Roots of seedling*





*Planting seedling*



*This picture shows the use of tomato hooks and the lower-and-lean method.*

## **TRELLISING**

The habit of tomato plants is to trail along the ground: they want to trail and put down roots every so often to spread their seed as far from the main stem as possible. This tendency, unfortunately, invites disease and keeps many of the fruits near or on the ground, making them irresistible to pests. To prevent this issue, you can train your plants up off of the ground on a trellis.

My trellising system is simple and requires just a few pieces of wood, heavy twine, and landscape staples. (I have several videos on my YouTube channel that will walk you through the process.) This system will enable you to support 12 to 15 plants, will keep the tomatoes off of the ground, and will invite better air circulation. It works well for areas with shorter growing seasons, and you'll be able to grow many more plants in a smaller space. To make a trellis, securely anchor two long wood two-by-fours in the ground to hold up the trellis. (They shouldn't be any taller than you can reach.) Next, secure a third two-by-four across the top ends of the anchored two-by-fours to create a frame. You'll then attach smaller pieces of wood (one-by-ones work great)



across the top two-by-four. The one-by-ones should be spaced about 12 inches (31 cm) apart and positioned so they're perpendicular to the top two-by-four. Finally, attach several lengths of heavy twine to the ends of the one-by-ones. The lengths will need to be long enough to reach the ground, at which point you'll anchor the twine to the ground with the landscape staples. You can then plant your tomatoes at the base of each length of twine. You'll want to carefully wind the tomato vines up and around the strings every few days. (You can assist the plants by using tomato clips, which are simply small, round clips that help tether the plants to the string.) Once a plant reaches the top of the trellis, it won't stop growing and will eventually flop over, at which point it can snap off. If it doesn't snap off, it can reduce airflow at the top of the plant, which creates a breeding ground for bacteria. To prevent this, cut off the tops of the plants at trellis height to redirect the plant's energy back into ripening the fruit it has already set.

### **LOWER-AND-LEAN METHOD**

In longer growing seasons, you can use the *lower-and-lean method* to train your tomato plants up a trellis. Instead of cutting the plants off at the top like you would with trellising, you'll grow the plants *around* the trellis, which will enable them to grow much larger, and also support more fruit. For this method, you'll need to affix eye (or cup) hooks to the bottom sides of each end of the one-by-ones on the trellis. You'll then attach tomato hooks to the eye or cup hooks and then run the strings down to the ground where they'll be anchored with landscape staples, just as was done with the trellising method. The plant will then grow up the string, but instead of cutting off the plants when they reach the top of the trellis, remove the tomato hooks from the eye or cup hooks, unthread some of the string, and then move the tomato hook to the next eye or cup hook on the trellis. (You'll do this for all of the plants on the trellis.) You'll continue this "rotation" process throughout the season until, at the end of the season, you have long vines spiraling around the trellis. The only seasonal pruning required is the removal of any lower leaves that show signs of yellowing or disease. The bottom



few feet of your plants will look a bit naked, but this won't harm the plants in any way.

## **COMPANIONS**

Just when you have everything you need to grow juicy, flavorful tomatoes, in come the pests to try and stop you. Fortunately, companion planting can come to the rescue. Let's start with the most famous tomato pest: the tomato hornworm. Hornworms can strip the leaves off your plants within days, but there are two companion plants that can help you deal with these chubby little devils. One of them is basil. The very reason I love basil is the reason hornworms hate it—the scent! Recent research has revealed that the scent of basil and other plants actually can mask the scent of the tomatoes, confusing pests like the five-spotted hawk moth (which is the tomato hornworm moth), which finds tomatoes through smell. So plant basil in and around your tomato plants to keep hornworms at bay. Another beneficial insect that can take down hornworms are parasitic wasps. These creatures are very stealthy and lay their eggs under the skin of the worm. The eggs hatch inside the worms, and the babies eat the worms up from the inside. To attract these tiny, otherwise harmless little wasps, you should grow lots of plants from the carrot family, including carrots, celery, dill, and fennel. It's the flowers from these plants that attract the wasps; they provide the nectar and pollen that the wasps love.

Another common pest is the stink bug. If you have stippled, colored spots on your fruit, it could be the work of a stink bug. One way to keep them off of your tomatoes is to provide them with a crop they like even better: cowpeas. Planting cowpeas 5 to 10 feet (1.5 to 3 m) from your tomatoes will draw stink bugs away from the tomato plants.

If you see tons of small holes in plant leaves, it's probably the work of flea beetles. Similar to stink bugs, there is a crop they like better than tomatoes: radishes. However, unlike the stink bugs, flea beetles don't move around a lot, so you should plant radishes in and among tomato

plants and then let them go to flower to attract even more beneficial insects to your garden.

One pest that is really difficult to get rid of once it's taken hold is the red spider mite, which can cause yellow bumpy leaves and withered flowers. If an infestation is bad, you'll see webs on the undersides of leaves, at which time it may be too late to save your plants. However, you can head them off at the pass by planting alliums around your tomatoes. The smell from onions, garlic, and chives will confuse the mites, so they should then leave your tomatoes alone.

There are a couple of bad plants to have around your tomatoes. Potatoes are a member of the nightshade family and, like tomatoes, share the same diseases, but they are even more prone to getting them than tomatoes. Make sure you grow potatoes and tomatoes at least 10 feet (3 m) apart to keep disease from spreading between plants. The other enemy of tomatoes is the black walnut tree. Its roots secrete a substance called *juglone* that can stunt or kill a lot of crops, including tomatoes. A walnut tree's root spread is about two to three times the tree's diameter, so you should plant tomatoes well away from these trees.

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**Brian Lowell** lives and gardens in Southern California (zone 10a) with his wife, Emilie; son, Noah; and little terrier, Boomer. He's been gardening for over 30 years and from the age of 13, and for 10 of those years he was mentored by a University of California Certified Master



Gardener. Through his Next Level Gardening YouTube channel and website, Brian passes on the gift of inspiration and knowledge that he was freely given three decades ago by an amazing gardener who probably never knew just how important a role she played in his life. His hope is that he can help you discover what a life-changing pastime gardening can be.



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